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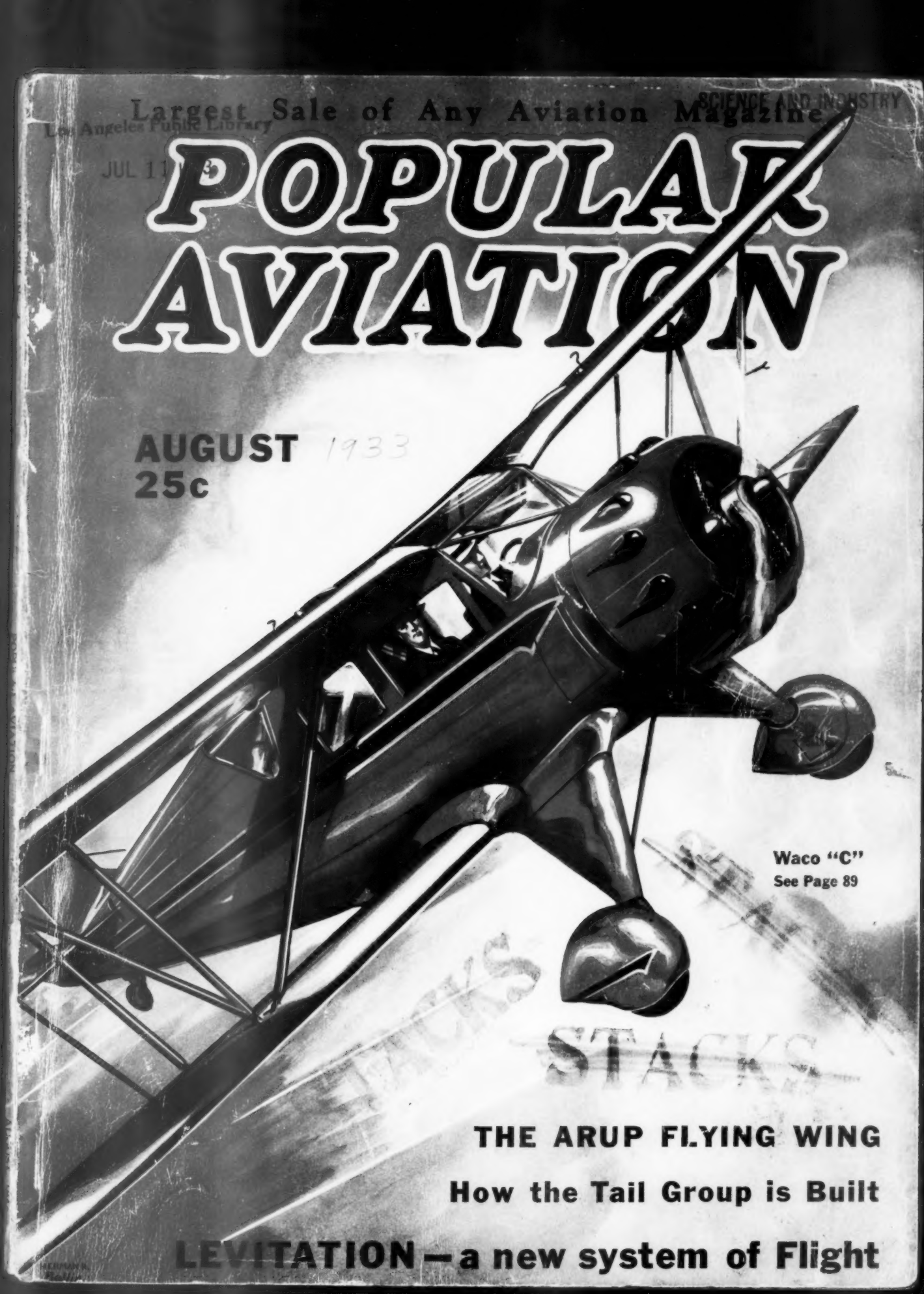

Waco "C"
See Page 89

THE ARUP FLYING WING

How the Tail Group is Built

LEVITATION—a new system of Flight

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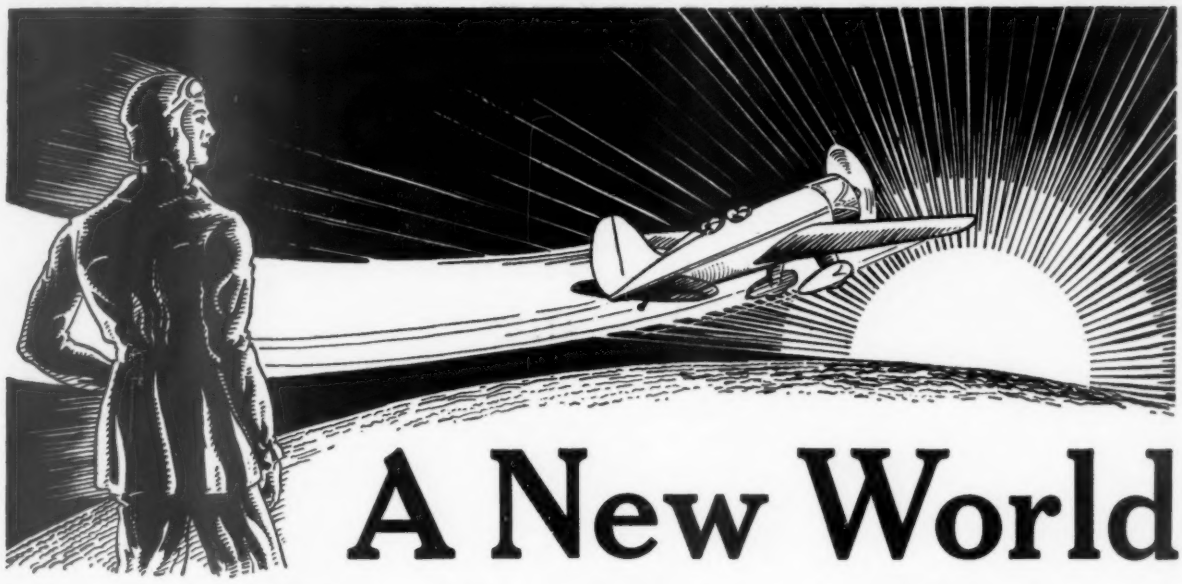

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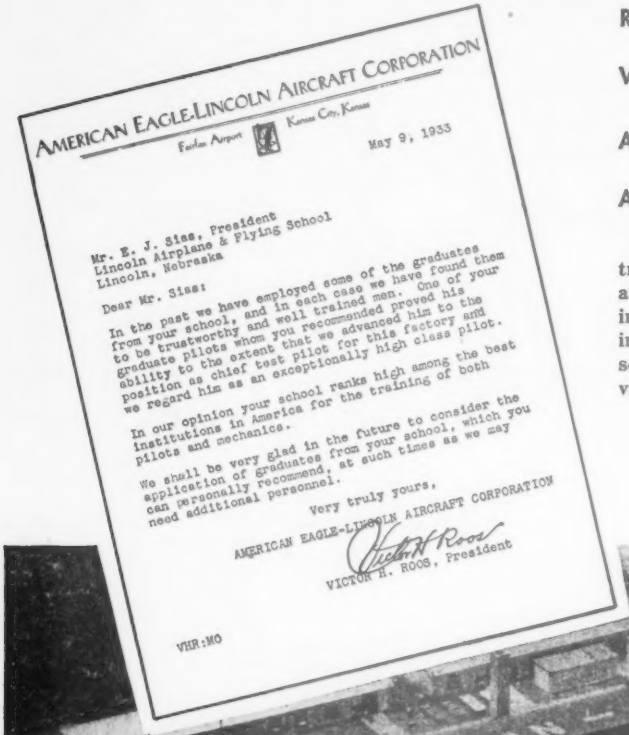

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Victor H. Roos
VICTOR H. ROOS, President

VHR:MO

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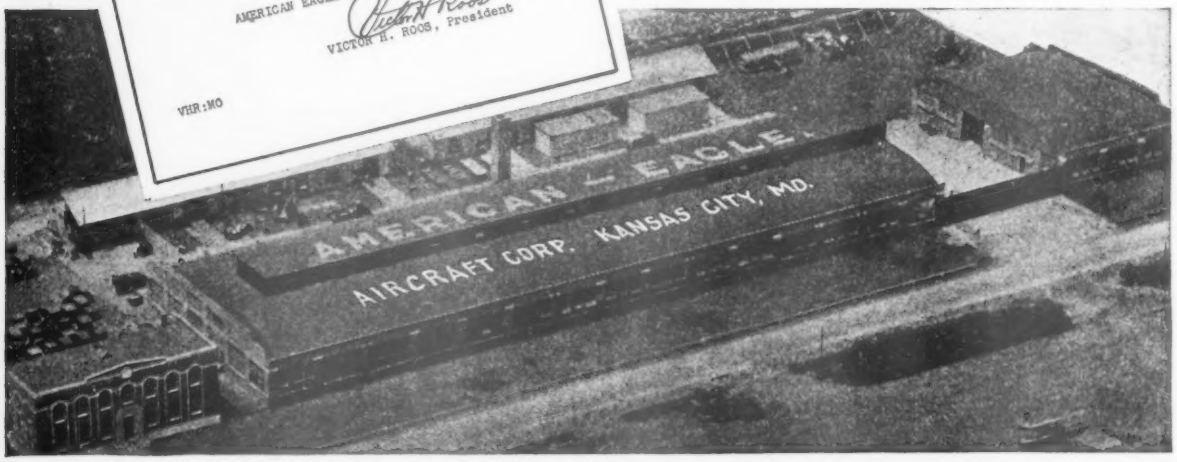

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An Airy Chat With the Editor

HOLDING reveries in a junk shop is one of my favorite pastimes. I get a lot of kick out of the various discarded mechanical appliances that such yards display for the reason that mechanical history is written there.

Amidst the assorted bolts, nuts, screws and castings will always be found some interesting mechanism that has outlived its usefulness for various reasons. Of course, there are the worn-out standard parts of machines that are too well known to be of much interest, but at the same time, there are frequently sparkling new parts that never saw service and were junked because they could not be merchandised. They were not always failures mechanically but flopped commercially.

* * *

AND so, while holding an inquest over the remains of the various aeronautical relics at the Air Show, Century of Progress Exhibition, I casually ran into a clean neat sparkling specimen of a Roberts two-cycle engine, as clean and bright as the day that it left the factory.

It was the sole surviving relic of the days when C. W. Roberts played around with the two-cycle principle in the hope that it would simplify the aeronautic engine problem. He attempted to crack the nut of valve grinding, racketing and clashing tappets and all of the other complexities of the four-cycle engine. This particular model of the Roberts engine was one of the earlier models, a six cylinder engine built before he devised his ingenious tunnel distributer and is therefore correspondingly more interesting.

The Roberts two-cycle dates back to a period before the World war, probably to 1910 or 1912. It was hard to start, sometimes difficult to stop and never idled properly, but it contained the germ of a big idea in engine building. Take a look at this old baby when you come to the Chicago Fair and see if it does not give you the same inspiration to tackle the two-cycle problem as it did the writer.

* * *

STRESS analysis and safety factors are two of the quaint old customs indulged in by all engineers. After elaborate calculations carried out to the nth decimal place, the stress engineer believes that he has found the load carried by each wire, strut and bolt and that he has provided a sufficiency of material to resist these stresses.

Then, just to prove that he fully trusts these figures, he multiplies them by the "safety factor,"—six, eight, ten or twelve times according to fancy—just to be on the safe side. Hence the name "coefficient of ignorance" as the safety factor is often called.

* * *

IT'S an ill wind that blows nobody good—so goes the old saying, and this seems to be true in the case of the new licensing situation. The new requirement of 50 solo hours for a private pilot's license has worked a hardship on many students, but at the same time it has effectively promoted the cause of the lightplane.

When it becomes necessary to run up five times as many hours to win the ticket, as before, the students begin to look around for a suitable lightplane that can be operated for $3.00 per hour in place of the big trainers that rent for $10.00 to $15.00 per hour. Further, the private flyer can fly oftener after getting his license and in this way can "keep his hand in" by using the flivvers.

* * *

DOWN in Indiana they are experimenting with a tailless plane that shows great promise to judge from the demonstration witnessed by the writer. The "Arup," as this plane is called, is the invention of Dr. Snyder of South Bend, Ind., who has been working on the idea for seven years. While not all of the "bugs" have been ironed out of the Arup, yet its performance is very creditable for a first tryout with a radically different ship. Read about the Arup in this issue.

* * *

EVERYBODY always gets all worked up when a new fuel oil engine appears, because they believe that this means reduced cost of operation. As a matter of fact, such a reduction in operating expense would be only temporary at the best for the cost of petroleum fuels is governed by the same laws of supply and demand which regulate every other product.

Should the demand for fuel oil be increased appreciably, then the production of gasoline would be reduced and fuel oil prices would soar. The refiner has to get just so many dollars out of every barrel of crude oil that he refines and it makes no difference whether the finished product is gasoline or fuel oil.

* * *

HOW many of our readers remember the exploits of the NC-4. Is it possible that the Lindbergh episode has entirely wiped out memories of the earlier transatlantic flights made by the U. S. Navy flying boat? Well, anyhow, we are now celebrating the fourteenth anniversary of the NC-4's triumph over the Atlantic and this was some years earlier than Lindbergh's flight. You gotta give the Navy credit for this job.

* * *

HEADLINE newspaper publicity frequently works wonders. Comparatively little attention was paid to the achievements of the NC-4 but the "Spirit of St. Louis" with Lindbergh as pilot was a front page feature for months. As a result, many more people are familiar with the name of Col. Chas. Lindbergh than they are with the name of Commander Reid who made the transatlantic flight nearly nine years earlier than Lindbergh.

* * *

OF late, everytime that a new plane is placed on the market, the manufacturer's prospectus carries the line, "The performance far exceeds our en-

(*Continued on page* 127)

PLEASE NOTE!

WE wish to call your special attention to three matters of extreme importance. First, this is our last notice to intending members of the Lightplane Association. The dead line for membership is September 1, 1933.

This organization is not for profit, but is for the protection of amateur builders and pilots who have been grounded by the various state laws.

Second, if you wish to see the biggest aeronautical display in the world, come to the Century of Progress exhibition in Chicago. Better hurry.

Third, please notice the changes that have been made in the Barter and Exchange requirements.

XUM

POPULAR AVIATION

Including SOUTHERN AVIATION

A MAGAZINE FOR THE PROMOTION OF AMATEUR AVIATION AND PRIVATE FLYING

Volume XIII | AUGUST, 1933 | Number 2

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The Arup Flying-Wing—

A three-quarter view of the Arup with Dr. Snyder, the inventor. Note particularly the high landing gear and the great wing thickness.

by

J. B. ROBERTS

AFTER several years of investigation and experimental work on a small scale, Dr. Snyder, South Bend, Ind., has successfully flown the first full size power driven tailless plane, the "Arup," at his local airport. Further, it is said, that the "Arup" is the first flying wing of any kind to fly in the United States although several have been flown in France and Germany.

After trying out the principle on small models, Dr. Snyder constructed a tailless glider and then started work on the present power driven machine which promises to have a marked influence upon future airplane design in this country. The first public flights were witnessed by the writer who was greatly impressed with many of the characteristics displayed by this little monoplane. Although powered with one of the smallest engines on the market, it reached nearly the 100 m.p.h. mark, had the ability to zoom sharply and to climb at a fair rate of speed.

In plan, the lifting surface is semi-circular in shape with the straight edge of the semi-circle used as the leading edge. While the span is only 19 feet, yet the wing area is 211 square feet, an amount of surface that is quite surprising until one stops to consider that the entire length and width is surfaced. As can be seen, the aspect ratio is very small and yet this arrangement did not seem to detract very greatly from the performance. Its compactness and diminutive dimensions were accentuated at the trials by the huge spans of the Army and Navy ships which attended the air-meet in progress at the time of the tests.

Although several other arrangements have been suggested, the ailerons of the experimental machine are now placed at the wing tips where they appear to provide adequate control in all maneuvers. The horizontal elevator and the adjustable stabilizer, or trimmer flaps, are placed within the rear arc of the semi-circle. The trimmer flaps, which correspond to adjustable stabilizer surfaces, are adjusted for various flight conditions by a nut and screw arrangement which is accessible through a covered slot over the hinges. Standard stick and rudder bar controls are employed in their usual relation.

It will be noted that the lifting surface, I can hardly call it a wing, is in contact with the tapered nacelle throughout its length, thus doing away with the power consuming eddies that are in evidence with the conventional wing and fuselage arrangement. It is entirely likely that the reduction in the eddy losses tends to compensate for the low aspect ratio loss, a fact that was quite noticeable in the performance.

FLYING tests made recently with the Arup have proved conclusively, the practicability of the flying-wing principle.

We believe that the flying-wing plane marks a new and important step in lightplane design, more particularly with the lightplane than with larger ships because of its compactness and inherently great structural strength.

One of the most noticeable characteristics of the Arup is its unusually high speed range. With a top speed of 97 m.p.h. and a landing speed of 23.0 m.p.h., we have all that can be desired for the use of the private owner and flyer. During the tests, the plane slowed up so rapidly in respect to its descent that it seemed to mush down along a line nearly as steep as that of an Autogiro, dropping from 97 m.p.h. to 23.0 m.p.h. at an angle of 1:3 very quickly in a total descent of about 50 feet. Thus it is well adapted to landing in small fields or on rough ground.

Had a more powerful engine been installed in place of the tiny 40 h.p. Continental, the climbing rate could have been vastly improved as well as an improved top speed, but considering that the power loading ran up to the figure of 21 pounds per h.p., the little ship did very well indeed, and speaks well for the efforts of the designing engineer, Raoul Hoffman. A 50 h.p. or 60 h.p. engine would have probably brought the climbing speed up to above 800 feet per minute.

Getting back to the subject of the wing, the all important part of this ship which consists of about 80 per cent wing, the section employed is a modified M-6 which is noted for its stability. Whether this is the ideal section for this type of plane is not yet known and can only be determined by future experiments.

As can be imagined, the wing is very thick near the body, and from this point outward, gradually tapers down to a thin edge at the outer extremity of the surface. A considerable amount of storage space is thus provided near the leading edge which can be devoted to baggage or gasoline tanks.

There is one point of importance that cannot be overlooked, and that is its well defined resistance toward spinning. According to the test pilot, Glenn Doolittle and the engineer, Raoul Hoffman, it is impossible to force the Arup into a spin by any ordinary methods. When stalled, it mushes down slightly and then noses down automatically until flying speed has been attained.

There is no question as to its maneuverability, for during the demonstration it was repeatedly put through vertical banks and very tight figure eights with great ease. Maneuverability and response to the controls, which have always been questioned in respect to tailless ships, have been demonstrated satisfactorily in the test flights of the Arup.

The wing is of the usual wood construction while the fuselage is welded steel tubing. There are no unusual points in the structural features that call for a description except that the landing gear is unusually high. Be-

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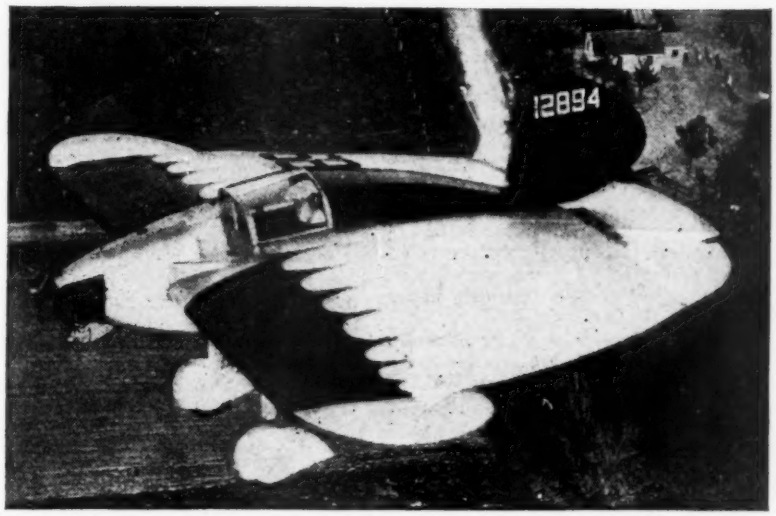
A New Note in Aviation

A REPORT on the test flights of the first practical American flying wing plane which will be of particular interest to lightplane builders and amateur pilots. Equipped with only a 40 h.p. engine, this ship put up a very creditable performance.



The Arup in flight, showing the control surfaces and wing form. The spats and pants shown here do not exist on the test machine but were added to indicate how the landing gear can be streamlined.

cause of the form of the wing and its tapering thickness, only two ribs are of the same size, but as there are only a few ribs in the ship, this is not much of a problem. There is also an unusual amount of storage space in the rear of the nacelle, which Mr. Hoffman humorously remarks, provides sufficient space for 200 women's hats. I often wonder how he arrived at this method of estimating cargo space!

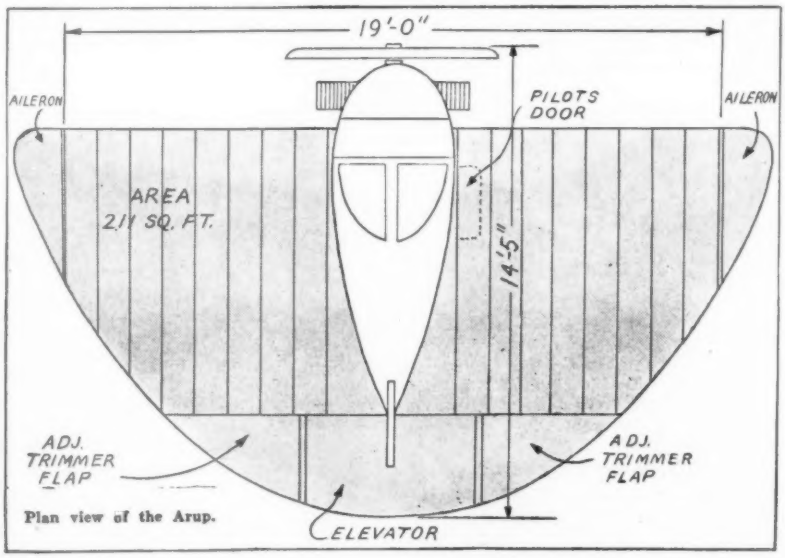
A look at the specifications will be interesting as a means of comparing the tailless Arup with standard type airplanes. There are many features that cannot be well incorporated in such specifications but it will at least serve as a basis of comparison.

SPECIFICATIONS OF THE ARUP (S-35)

Wing span	19 ft. 0 in.
Wing area	211 sq. ft.
Wing chord	14 ft. 0 in.
Length overall	15 ft. 4 in.
Weight empty	590 lbs.
Weight fully loaded	780 lbs.
Wing loading	3.68 lbs./sq. ft.
Power loading	21 lbs./h.p.
Top speed	97.0 m.p.h.
Landing speed	23.0 m.p.h.
Stalling speed	22.0 m.p.h.
Rate of climb	450 ft./min.
Speed ratio	1:4.2
Engine	40 h.p.

Advantage has been taken of the "snow-bank theory" in gaining visibility for the pilot. This theory was discussed in the July issue of POPULAR AVIATION and provides a means of streamlining where cutouts are made in a streamline nacelle. This will be noted in the photographs as an open space lying between the engine cowl and the pilot's compartment where an eddy guides the air stream over the nacelle. It is said that this reduces the resistance by about ¾ of one per cent.

The pilot gains access to the cabin through an opening cut in the lower surface of the wing as indicated by the dotted lines on the outline drawing. After he is seated, he draws a window over this opening, thus thoroughly enclosing himself and at the same time closes the wing outline on the lower surface. When seated, he has a very good range of vision, above, to the sides, below and to a limited extent, forward. There is ample room in this compartment, much more than would be estimated from a casual survey of the ship from the outside.



Plan view of the Arup.

Entrance to the cockpit has always been a difficult problem with a plane of this type because it is not practicable to run a walkway over the top of the wings. It is in this respect that a pusher type has the advantage because the pilot and passenger can enter the cabin directly through the nose. However, this difficulty is one of the minor details that will probably be remedied in future production of Arups.

Because of the great chord of the wing and the angle at which it is now set, the front landing gear struts are unusually high. While the experimental model, for obvious reasons, was not provided with spats or boots—for the objective was to get the ship flying at the earliest possible moment—yet the streamlining of the long landing gear struts would undoubtedly have improved the speed and climb. It is just one more of those little details that are omitted on every experimental machine, especially a first model. Possibly the Arup would have passed the 100 m.p.h. mark if it had not been for this omission.

There is one factor that has not been commented upon to this point and that is the structural advantages of a flying wing ship. The great chord of the wing leads to a very thick wing section and this in turn permits of exceedingly deep wing beam so that the cantilever

system is at its maximum efficiency. The wing structure is more than ordinarily rigid and the danger of wing stripping is very remote. Further, the nacelle is relatively short and deep so that the combined structure is unusually sturdy. This is just one more safety factor that is inherent with the flying-wing type of plane.

The matter of aspect ratio and its advantages has been harped on so often from all sides that this feature of the design has been largely instrumental in holding back experimental work with the flying wing type of ship. However, let it be said that the influence of aspect ratio has been greatly overrated and that the L/D improvement due to a large aspect ratio is true only under limited conditions.

For example, a wing flying normally at an angle of attack below 3-degrees is not influenced by the aspect ratio at all, and it is only when the flying angle exceeds 6-degrees that a high aspect ratio shows an advantage great enough to compensate for its disadvantages. Therefore, the Arup with its light loading, flies normally at a low angle of attack, such a small angle in fact that aspect ratio means little or nothing.

On the other hand, a large ratio means thin wings, comparatively shallow weak wing members, a large span for a given area and makes the machine cumbersome to handle and expensive to store. I am not at all an advocate of large aspect ratios for all classes of ships, although I must confess that a large A. R. has its advantages where a ship, heavily loaded, flies normally at a high angle of attack.

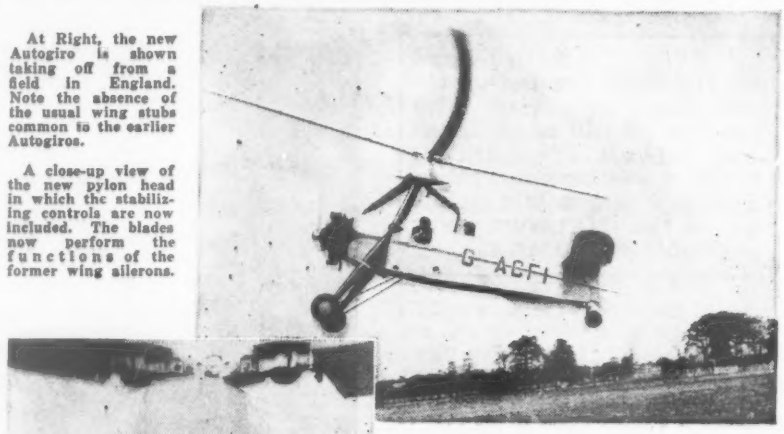
Under the latter condition, the L/D ratio is materially improved but not otherwise. Just as an example, racing planes that fly at a small angle of attack usually have a very low aspect ratio, and if the A. R. had the slightest advantage in the way of lift-drag, such planes would most certainly be given a large aspect ratio where every ounce of drag must be eliminated.

In summing up the results of the demonstration, I must say that I was quite favorably impressed with the performance of the Arup. Of course, there are many "bugs" to be ironed out before perfection is arrived at, but this is always true of any brand new project. For a first trial, the Arup performed surprisingly well and there is no reason at all why it will not prove itself a recognized type, at least in the light-plane field.

It is quite difficult to make direct comparisons with standard type light-planes of equivalent powerloading, insofar as top speed is concerned, for the reason that there is a considerable variation among the standard planes themselves.

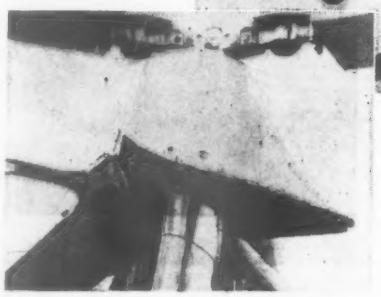
For example, one monoplane which is loaded to 18 pounds per horsepower has a speed of only 92 m.p.h., while a certain light biplane, carrying the same Continental 40 h.p. engine has displayed a speed of 105 m.p.h.

Cierva Simplifies the Autogiro



At Right, the new Autogiro is shown taking off from a field in England. Note the absence of the usual wing stubs common to the earlier Autogiros.

A close-up view of the new pylon head in which the stabilizing controls are now included. The blades now perform the functions of the former wing ailerons.



DON JUAN DE LA CIERVA recently demonstrated his latest improvements on the Autogiro. It is claimed that the performance is now much better than with the original type and that it is much easier to handle in flight.

In this machine, the small stubby wings are entirely eliminated and with them goes the old aileron control. All lateral control is through the rotor blades themselves, the only control surfaces being the stabilizer and rudder. Dual controls are installed and the whole ship is cleaned up markedly.

If Cierva has done nothing else in this new edition of the Autogiro, he has at least proved that 100 percent. of the lift can be performed by the rotors. This is an answer to his critics who have long claimed that a large portion of the work was accomplished by the old type stub wings. Probably the next step will be the substitution of a rotor for the elevator flaps.

A Gnome Powered Jenny

HERE is a wartime hybrid with a vengeance. Raymond Cocking, Colton, Calif., sends us this picture of a Jenny equipped with a 165 h.p. rotary Gnome engine, a combination that was assembled at Riverside, Calif.

He says that it is very neat looking job and that it flies very nicely with a top speed close to the 100 m.p.h. mark. It has been quite a curiosity in California where it has attracted a great deal of attention. While we doubt whether this combination would awake any enthusiasm in the hearts of Department of Commerce inspectors, yet we note that Jenny proudly displays the identification number 6812. Wonder if she still uses castor oil?

Well, well! Here's an old Jenny with a Gnome rotary engine in place of the conventional OX5.

The Exploits of Rockwell

by JAMES FARBER

A story of the famous Lafayette Escadrille and one of its brilliant commanders, *Ajutant* Robert L. Rockwell of Cincinnati, O.

THE scene is Cachy, Somme, France. Officers are throwing jackets over pajamas. Mechanics are wheeling fleet Spads over the tanbark. A few motors have already coughed themselves into roars.

Flying high over the lines, some 20 miles away, a formation of enemy planes has been sighted. Word has been telephoned to the aerodrome for defensive assistance. The day's patrols were finished, but this was an encore.

Each plane taking off from the boggy field beyond the tanbark is marked with a ferocious Indian's head. An Indian head as an insignia on French army planes? Incredible? Not at all. The squadron is part of the Lafayette Escadrille, fighting in the Foreign Legion for France. Its members are Americans. Its service has been long and brilliant. Its decorations have been many.

Sitting at the controls of the leader's ship is *Ajutant* Robert L. Rockwell, Cincinnati-born, American college-bred and French army trained. One hand grasps the slender joystick of his Spad and the other is poised to signal to his men and to follow the motion with a tug at his trigger wire.

Rockwell waves his arm in the air. It is a signal for a change of direction. Sticks are pulled back. Noses bob upward. The enemy is diving with throttles wide open. Now the enemy is below. The trick has worked. Only Number Three man has been caught by Jerry. Rockwell kicks his rudder and aims his nose at the nearest enemy. He gives him a burst of fire. Every fourth bullet is a tracer, leaving a long trail of smoke behind it. He has aimed too far to the right.

A little re-adjustment. Rockwell's hand once more seizes the trigger wire. A short burst. The target wobbles, falters, banks sharply on a wing—and begins a headlong fall to the earth, hopelessly out of control.

"The Dog Fight," reproduced from a wartime painting by the French artist, Henri Farre. This particular action was sketched from "life" by Farre who was an observer in a French reconnaissance plane.

The dogfight is over in ten minutes. Several tallies have been made. New graves will be dug. A dangerous observation mission has been filled. And the Lafayette Escadrille has acquitted itself once more with credit.

It is not easy to dig a dogfight story out of the quiet reserve of Robert Rockwell as he sits on the veranda of his Dayton, Ohio, home of evenings. If you are not just a curiosity seeker, he will talk to you about the war. But on the subject of his personal victories, he is not loquacious.

NOW addressed as Col. Rockwell, commander of the 485th bombardment squadron, U. S. Army Air Corps Reserve, he joined the French army's famed Foreign Legion in January, 1916, and was mustered in as Number 13 on the rolls of the Lafayette Escadrille. He saw service on every front and in every major campaign. He fought side by side with Guynemer, Nungesser, Norman Prince, Raoul Lufbery and lived to command the Escadrille.

Rockwell has a story to tell.

To begin at the logical point—his enlistment in the Legion—Rockwell did not find himself in such auspicious circumstances. He received one cent a day for the hardest kind of military labor. But with his "escape" into the newly formed volunteer flying unit, he had a chance to qualify for real pay: a raise to five cents a day and a corporalcy for receiving his flying license.

After completing 30 hours of patrol duty over the German lines, Rockwell found himself in a veritable windfall of remuneration. That 30th hour meant regular wages of 150 francs a month.

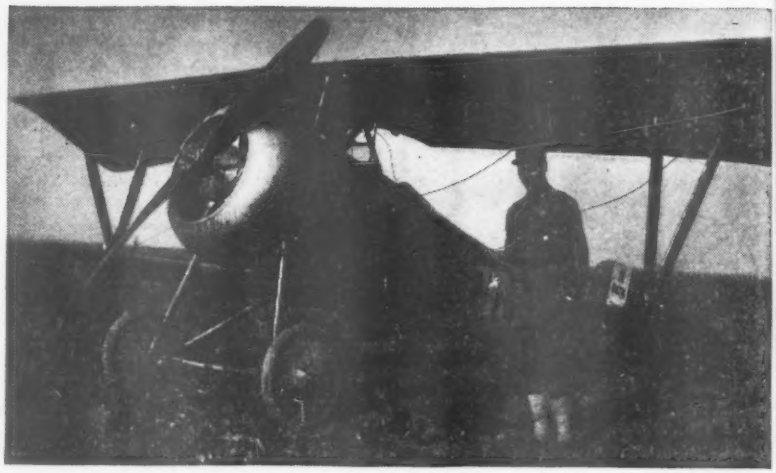
As if this good fortune weren't enough, there came an American angel on the scene in the form of William K. Vanderbilt. Through his Paris bankers, the powerful Morgan, Harjes, et Cie. Vanderbilt had arranged to give an allowance of 100 francs a month to every American in the French air service. That allowance continued to the end of the war and was even increased, in 1917 when America entered the war,

A rare photograph of Capt. Robert L. Rockwell, standing beside his Spad. Note the Indian head insignia painted on the fuselage, denoting the American Lafayette Escadrille and also the tail-group identification markings.

to include all American army pilots—at 200 francs a month!

Life was not all beer and skittles in the Escadrille however, even with such bright spots in the calendar's horizon. Each patrol piled up casualties. The war was not progressing satisfactorily. Men and equipment were constantly needed. New pilots were lucky if they lived through their first brushes with the enemy. It was a case of the survival of the fittest.

Harold Willis, who conceived the showy emblem of the Escadrille, was brought down in enemy territory and given up as lost. In a day or so, a German formation flew over the Escadrille's field and dropped a message telling of Willis' capture. Willis escaped from a prison camp, crossed most of Germany, swam the Rhine and rejoined his outfit. His return was the occasion for a great celebration. But he was lucky.



Lieut. Courtney Campbell standing beside the Nieuport that he flew home to safety with the lower wing shot away. Note that the interplane struts are dangling free from the upper wing.

THERE was Edmond Genet, from Ossining, N. Y. Genet went up one fine day just after America came into the war and was shot down by an enemy patrol. He was a lineal descendant of the famous Citizen Genet who was a revolutionary French envoy to America in George Washington's time. Every schoolboy has read about him. And Genet was one of the first flyers in the war to be buried under the Stars and Stripes.

A young officer named Hobbs, star track athlete from an American university, was flying in a patrol with his nose close to Rockwell's tail structure. It was his first flight over the lines. An enemy Archie shell exploded in his lap. It was a 10,000 to 1 shot, that being the ratio of chances army pilots assigned to antiaircraft as likely to do them harm.

Rockwell knew and flew with the celebrated French aces, Guynemer and Nungesser. Guynemer went forth one day never to return and never to be found. Rockwell believes that the ace was forced down in No Man's Land during a heavy bombardment and was blown to pieces with his ship. It was an explanation of other disappearance cases. . .

Nungesser, with Coli, survived the war with its comparatively flimsy flying machines and embarked on a Transatlantic flight attempt only six years ago—and disappeared.

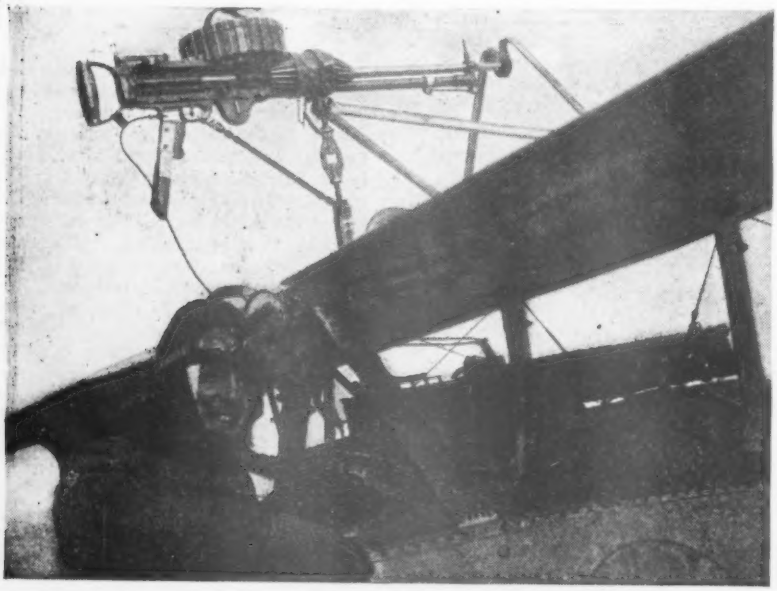
Rockwell did not approve of Guynemer's combat technique. Each man used his own, since circumstances and the personal equation entered into each skirmish with the enemy. But Guynemer carried technique a little too far, Rockwell believes. The great ace almost invariably let the other fellow take the first shot at him. This explained the hundreds of holes drilled through the ships he brought back after an encounter. But the psychology was easily explained. His adversary, emboldened, rushed for the fray like an incautious bull. Guynemer, a master of aerobatics, closed in for the kill.

Nungesser, on the other hand, practiced until nothing was left to chance. Every move was calculated toward the swift destruction of his opponent. He waded into combat with guns spitting lead and never gave the other fellow a foolish advantage.

Rockwell followed this procedure when circumstances permitted. But sometimes they didn't. Lieuts. Thaw, Soubiran and Rockwell were on patrol duty one day over Verdun during the second great offensive. Rockwell, flying a slower ship, was unable to keep pace with Thaw and when he discovered an enemy patrol below him, decided his best chance in view of superior numbers, was to dive and fight.

He singled out his man and shoved his stick forward. With his first burst, he scored. But it was also his last. His engine "fell out" on him, and he found himself charging an enemy with a cold motor. He says he doesn't know for sure that his motor was colder than the sweat that stood out on his brow.

Enemy guns shot his oil line in halves and spattered from head to feet with oil, he narrowly missed crashing into a sausage balloon. He landed with bullet holes in every part of his Spad. On another day, however, Rockwell met a lone enemy and at a quarter of a mile, against all the better precepts of aerial gunnery, let his prospective antagonist have a burst "just for the devil of it." To his complete amazement, the German's nose dropped down, a burst of flame leaped from the gas tank and the vanquished ship fluttered helplessly downward, a blazing coffin.



An extemporized "over-the-wing" gun mounting used as an auxiliary to the rigidly mounted gun on the cowling. The wing mounted gun is controlled by the wire shown running from the trigger down to the pilot's cockpit. The pilot is Dudley L. Hill.

(*Concluded on page* 129)

A Waco Goes to England

by GEORGE GEYER

Why Lady Grace Hay Drummond-Hay, the well known English aviatrix, chose an American built cabin plane in preference to English planes of the same type.

(See the Cover Drawing)

LADY GRACE HAY DRUMMOND-HAY, London, England, world traveler and the leading woman journalist of Europe, who has been in the United States for the past four weeks, has returned to her home, possessor of a new Waco four-place cabin plane.

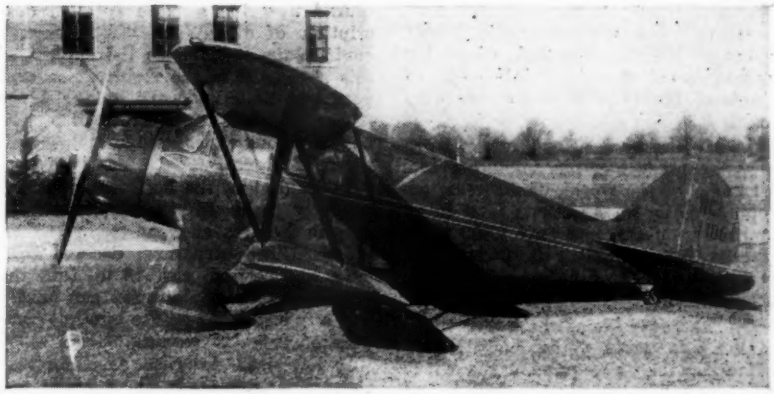
In commenting upon her choice of an American-made plane in preference to those manufactured in her own country, she set forth a very definite reason for her decision. She said:

"Until this year, with the production of several cabin planes for four passengers, the British aircraft manufacturers have not exploited the field of aircraft for the business man and the family. The Desoutter and the Puss Moth are the pioneers of cabin planes for family use.

"The Fox Moth followed, then the Percival Gull and the twin-engine Monospar are still more recent arrivals. I have owned a Puss Moth since 1930 and wished to acquire a new cabin aeroplane. My selection was rather limited and I did not wish to wait for newer developments. So, therefore, I naturally looked to America where the medium sized plane has been in production for several years and where I had a large range of choice.

"I do not feel that I am being unpatriotic in buying a foreign aircraft and importing it into England because I require a machine which is not yet developed in England. Had I needed a light plane, I would certainly have bought one of the many excellent light British planes on the market.

Lady Drummond-Hay, one of the best known women flyers, standing by the door of her new Waco "C".



A side elevation of the Waco Model "C" cabin biplane purchased by Lady Drummand-Hay and which will accompany her to England. This ship is pictured on the front cover of this issue.

"MY choice of an American plane was indeed quite difficult for there were several aeroplanes in this country which had claim on my attention. I put aside all the light planes because I felt I could do better in these in England. I had to eliminate the higher-priced and higher-powered American planes because I could not afford the initial outlay in the first place and the fuel maintenance in the second.

"The Waco four-place cabin model has the great advantage of wonderful visibility to the rear which is very necessary in Europe and especially in England, where, on summer days, our smaller aerodromes, club fields and airports are literally crowded.

You see, we have no method of ground signals for taking off, except at a few of the State airports and we are responsible for seeing that our take-off does not coincide with a landing of some other plane. Especially at week-ends during the summer, the fields are just dotted with private aircraft. The problem of 'air-traffic' is increasingly serious. The greatest possible visibility is therefore the aim of all British aircraft manufacturers.

"It is true that we have few aeroplanes in comparison with the United States, but a comparison must also be drawn between the area of England and that of the United States. Our fields are so much smaller than those in this country and so much attention must be taken to take-off and landings over obstructions. While other American aircraft no doubt have the same quality, this particular quality is also present in the Waco cabin, most noticeably since the Waco Company has provided the cabin model with air brakes which steepens the glide to our usual steep glide of British machines.

"We cannot afford to fly a machine which 'floats,' as it will not get into the smaller fields over obstructions without maneuvers which are frequently beyond the amateur private flyer.

"The Waco Cabin Model, powered with the Continental R-670, which I am taking to England, is a standard model. The Waco is a biplane, for which I have a preference, although one or two American monoplanes certainly tempted me. In short, the Waco cabin model suits me personally, and I look forward to introducing it to British flying clubs and aerodromes, whose members are familiar with and admirers of the several American ships of other types which have already been imported."

* * *

LADY DRUMMOND-HAY was the first woman to fly across the Atlantic Ocean, being a passenger aboard the Graf Zeppelin when it made its initial western flight which almost ended disastrously when a fin was damaged in a storm. She was also the first woman to fly around the world, again being the only woman passenger aboard the Graf Zeppelin when it made its epochal flight. Doctor Hugo Eckner, commander of the huge airship, has invited Lady Drummond-Hay to again be a passenger if he decides to fly across the Atlantic later in the year to attend the Century of Progress Exposition at Chicago.

For three years, Lady Drummond-

Hay has been flying and she has more than 200 hours of solo flying to her credit. Strange as it may seem, she received her first flying instruction in this country. This took place at Valley Stream, New York, and her instructor was Daniel Moulton. Returning to England, she received her British pilot's license at Heston, under the instruction of Captain V. H. Baker. In 1930, she bought a Puss Moth plane which she flew considerably on the continent. Last September, she took a course in "blind" flying at Hamble, England, where the standards of the "Air Ministry" of England for "blind" flying are very high.

Lady Drummond-Hay's work as a newspaper reporter has taken her into all parts of the world. Last year, accompanied by an American pilot in an amphibian plane, she flew 1,500 miles up the Yangtse River in China to a point within a few hundred miles of the Tibet borders.

On the underside of the upper wings of her new cabin plane, Lady Drummond-Hay has had painted the wings of a mammoth scarab, the fuselage of the plane forming the body of the sacred Egyptian insect. She has two scarabs, one being 2,300 years old which was found on a mummy in archaeological excavations near Memphis in the Nile Valley. The other is said to be a thousand years older and much larger which she had installed on the instrument board of her old plane which she sold recently. Both are in London for safe keeping although she plans to have one placed on the instrument board of her new Waco when she gets to England.

The plane is equipped for radio but she is waiting until she gets to England before having a European make installed which can be more easily maintained in Europe.

Having lived much in the Orient where mysticism is more or less prevalent, Lady Drummond-Hay is somewhat superstitious. Whenever she goes into the air, she takes a black cat with her that her mother gave her when she was married in 1920. It is a handsome velvet imitation of the real thing, but its owner positively refuses to go into the air without her constant air companion.

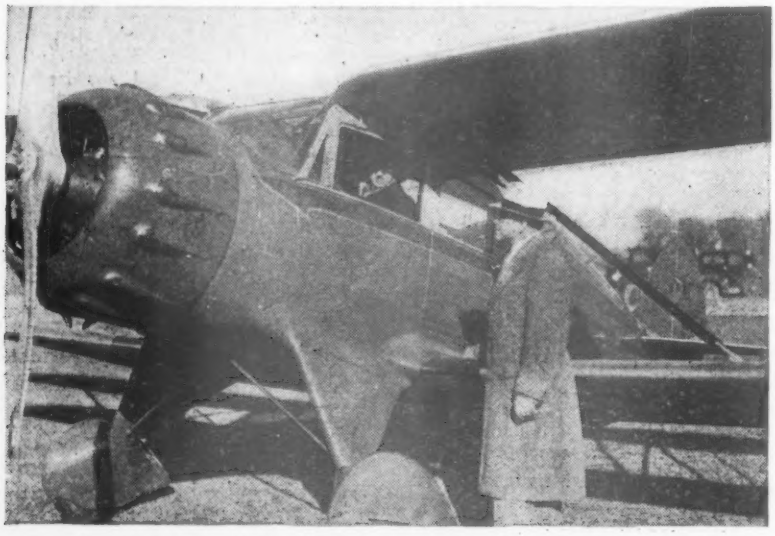
And now for a more detailed description of the Waco "C" four-seat cabin plane that forms the subject of this story. It is the result of several years development work by the Waco Aircraft Corporation, Troy, Ohio, who have had long experience in building all types of planes.

In its design, the builders have consistently held to the biplane type despite the present trend toward monoplanes. The structural design, however, has been so cleaned up that the most ardent monoplane fan can hardly find any argument on the score of complicated external bracing.

It has been designed as a medium size all-purpose cabin plane which can be adapted to many special purposes by slight changes in the cabin. It can be employed as a pleasure vehicle, as an ambulance, as a light express plane or other varied services.

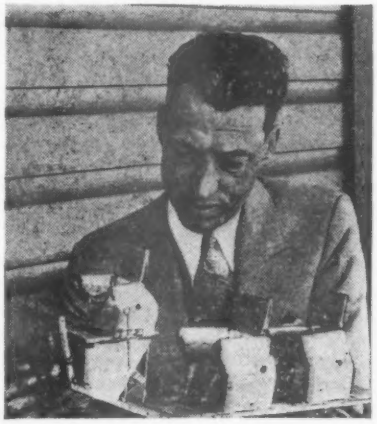
It is provided with a 210 horsepower Continental engine which gives the ship a top speed of 140 miles-per-hour. The cruising speed is 125 miles per hour, excellent performance for a four-passenger ship. The landing speed is 49 miles-per-hour.

The Waco Cabin has a throw over wheel control with dual rudder pedals and dual brake controls. Standard equipment is unusually complete and includes dome light, ash trays, door locks, controlled hot and cold air ventilation, tie-down ropes, medical kit, log book and canvas engine cover.



Close-up view of the Waco Model "C" cabin plane showing the various constructional details that distinguish this plane. Note the clear downward visibility over the leading edge of the lower wing.

He Slides 'em Through the Floor



The working model by which Guffy demonstrates his new parachute system.

PASSENGERS don't like to "bail-out" or jump in their parachutes even when facing death in a crash, hence John H. Guffy, Pittsburgh, Pa., has devised a method of chucking the passengers overboard in an emergency whether they like it or not.

When the pilot knows that a crash is unavoidable, he signals the steward who turns a wheel, thus opening the floor beneath the first passenger, who then drops out of the ship with his seat pack. A thin cable connected to the parachute causes it to open when the chute is 40 feet below the plane. Thus, nothing is left to the passenger's judgment. After passenger No. 1 departs, the other passengers follow in rapid succession, and Guffey believes that he can empty the largest plane in less than 45 seconds.

Lady Heath Forms Junior Club

UNDER the presidency of Lady Heath, the first aviation club for children in Europe has just been formed in Dublin at the Kildonan airport.

Lady Heath, who is an Irishwoman by birth, returned to Europe from America last year and, after spending some time touring England and Ireland in her Gipsy Moth airplane, joined the staff of Iona National Airways, the principal civil air company in Ireland.

Her children's club, which is called the National Irish Junior Aviation Club, has attracted a membership of several hundred and for twenty-five cents a year the children are admitted to the airport at any time. They also receive lectures on the theory of flight, airplanes and engines from Lady Heath and the other members of the staff of the Iona company.

Old readers of P. A. will remember Lady Heath as the Editor of the former "Women's Activities" column which ran for many years.

Salvaging Wartime Junk

by ALFRED CELLIER

Back in the 20's, warplanes and engines could be bought for a song, and the economical minded made all sorts of conversions out of this material, much to the detriment of the airplane industry.

THE desire for improved performance in ships operating commercially, immediately after the war, lead the barnstorming and other pilots to improve on what they had.

Airplanes were too cheap to go to the bother of building up anything new, so quite a bit of activity was in evidence at many a field. Such ships would hardly receive an A. T. C., from the Department of Commerce today, but nevertheless they held together and although some crashed at various times, I only recall one job that fell apart caused by rebuilding.

This particular ship in a sense was not rebuilt either, for only the wings, tail surfaces and landing gear were used. A former captain in the air service had conceived the idea of building up a fuselage from pipe fittings and regular iron water pipe. The ship was powered with a Liberty engine, so you can imagine the vibration produced on those weak fittings. When the test hop came off, he took a friend along with him. They got up in the air all right, but the ship disintegrated completely and they fell to their deaths, which might have been expected from that class of construction.

The lumbering Jennies and Standards were about the only two seaters available, unless you could get a De Haviland or a Bristol Fighter. So it was not surprising that some of the innumerable Thomas-Morse Scouts were converted with the idea of gleaning a few more miles per hour. These little ships only weighed 940 pounds empty, but were allowed 180 pounds for machine gun and ammunition, so that took care of the extra passenger.

No two were built alike, and when I decided to convert my own Tommy into a two-place job, I had the benefit of profiting from the others' mistakes and also was fortunate enough to have had the technical experience of a pilot who had charge of TM flying at one of the army fields, to assist me.

The main consideration was getting into the front cockpit. In all of the converted jobs I had seen, you had to squeeze through the incidence wires, or loosen them and then tighten them up after the passenger got in. Personally, that idea didn't appeal to me, but I have seen some built that way. It probably would have been all right if you could have obtained a signed contract to the effect that there would be no crack-up, but at that, I do not recall the undertakers having any increased business from this source.

My own Tommy flew better as a two-place ship than it did as a single seater. The front seat was out of a De Haviland, and the cowling was from an N-9 seaplane. The original seat had to be moved back fourteen inches, as was the original cowling. Only one wooden cross-member was removed, and this was replaced with a steel bar which gave greater strength than before. The only disadvantage involved was in cutting down the gasoline tank to an inverted L-shape, so that the knees of the passenger could go under it.

The author standing beside his converted Tommy Morse. Not a bad looking crate at that, but we'll have to take Mr. Cellier's word for the performance.

All of the other jobs I had seen, had only the gas tank removed and located elsewhere, with the passenger's seat placed in that particular bay; hence it was not necessary to change the center of gravity, but in my case, the stagger was dropped back twenty-two inches.

After it was all finished, you could step in and out of the front cockpit as you would in any other two-seater. Thomas-Morse orginally came out with a two place model known as the S-6, during the last days of the war, but did not produce them in quantity.

Further efforts on the part of the rebuilders, caused several of the Standard J-1's to become five-place cabin ships, with the pilot in the rear and in the open. These preceded the Lincoln Standard five-place ships which were open jobs and turned out at a later date.

Of course, some crazy ideas were bound to crop out with no official jurisdiction over the pilots and designers. I went to see one such ship, the owner of which was just putting the finishing touches on a Bristol Fighter which he had built into a cabin job. The only entrance to the cabin was a hatch in the top, with a ladder up the side of the fuselage so you could climb up there and drop in.

This entrance was very large and was put there as he could not cut up the longerons to put in a door. As he was showing this feature to me, I inquired how the passengers would get out if the ship went over on its back? He had to admit that he hadn't thought of that. Fortunately a fellow came along and bought it, converting it back to its original condition, which saved a good many future passengers from wondering that same question. About this time, the Bristol Company did produce a cabin ship from their famous fighter, which was used on the London to Paris route with considerable success.

A ship little known today, but which were built in considerable numbers, was the Boeing CL-4S with a Hall-Scott engine. This was a two-seater seaplane, but several had landing gears attached in place of the pontoons and joined the barnstormers. The first factory built cabin ship which set down on our field was a Dayton-Wright. The pilot wore a derby hat, and three persons sat side by side. There was no window in front, it was completely blind except for a small hole which the pilot looked out through. There were windows of course on the sides, and it was upholstered inside.

Due to the necessity of cutting down my gas capacity almost one third, by converting my Tommy, I gave thought

to remedying this condition. At first, for special long trips, I rigged up an N-9 wing tip pontoon, which was about half as long as the Tommy itself, under the fuselage, The gasoline was pumped up into the main tank by a hand operated wobble pump. When the ship was in the air, it gave the appearance of a torpedo plane with its weapon in place. I hate to look back now and think what might have happened if the ship had been pancaked in too hard.

Another pilot converted his Thomas-Morse on the same lines as my own. One day, while giving a student some dual in aerobatics, the student froze on the controls in a spin, and in his frenzy proved too strong for the pilot. The pyrene was wired in, and the instructor had nothing available to knock the student over the head with.

Marines drilling nearby, claimed that their whole battalion heard him yelling at the student to get his feet off the rudder-bar and let go the controls. They buried him five days later, and for nine months the instructor was in the hospital, four months of which he was in a plaster cast from his chest to his toes.

He remained conscious, however, and was able to tell the marines how to unfasten the safety belts and get them out. The cause of the accident rested with the student and not with the ship. If the accident had not been witnessed, everyone would have blamed the reconstructed ship.

It was not an unfamiliar sight for a barnstormer to fly around the country with an extra propeller tied on the side of the fuselage; a box of tools; chucks, for placing under the wheels; besides his suitcase of personal effects. The chucks came in handy, for often were the times when you had to pull your own prop through and it was a lot safer than just tying the stick back.

The Le Rhone engine on my ship had a self-starter that puts to shame the cranking of a modern inertia starter. This was made by the use of a Ford coil and a dry battery, with a button in the cockpit. A hole was drilled in the crackcase which was threaded and a plug provided. To prime the engine, I had a bottle of ether and one of those old fashion baby syringes. After putting a shot of ether in the crankcase and turning the prop over to charge the cylinders, you just got in the cockpit, put the switch on contact and pressed the button.

As in the Le Rhone powered ships, those equipped with the Gnome, had a large opening in the bottom of the cowling through which each cylinder fired as it went past. The rotary engines were noted for their fire hazard, but I have personally never heard of any trouble with the Le Rhones in this respect. The Gnomes however, lived up to that expectation if you were not careful.

In place of the familiar throttle,

(*Concluded on page* 132)

Auto Radios for Planes

Here we see an everyday automobile radio being installed in an airplane. Why not? It is small and light in weight.

AUTOMOBILE radios, made by the General Electric Company, are being installed in several training planes at Randolph Field, in place of the special airplane radio sets more commonly used. They are to be used for picking up weather reports.

This might be a good hint to our private flyers who could use car type radios instead of the highly expensive airplane receivers, saving money and at the same time simplifying the installation.

Investigates California Atmosphere

J. M. (SLIM) MENEFEE is shown with his meteorological apparatus by which he investigates the atmospheric conditions existing above Southern California. It is hoped that the compilation of this data will aid the Weather Bureau and at the same time will assist the studies of the California Institute of Technology officials who are about to erect a 200 inch telescope at some favorable point in this state.

This instrument, which automatically records air pressure, temperature and humidity on a soot covered drum, is taken aloft daily to a height of 15,000 feet by Menefee.

Slim Menefee adjusting his meteorological instruments before taking off in a search for bigger and better weather.

Monel Metal Satisfactory for Valve Seats

THE growing tendency on the part of engine manufacturers to use cylinder heads of aluminum and aluminum alloys is focusing the attention of the motor industry on the question of satisfactory valve seat materials.

The successful application of Monel Metal for this purpose in England is reported in an article in *The Nickel Bulletin*. It is based on the results of more than ten years' experience with the problem by an important manufacturer of airplane engines.

"While the aluminum alloy cylinder heads now almost universally adopted in aero engine construction offer many advantages from the standpoint of lightness and rapid heat transfer, their use introduces a problem not generally encountered when cast iron heads were utilized. We refer to the valve seats," the article says.

"From these are demanded properties not available in the aluminum alloy heads themselves. Consequently inserted valve seats of some other material have, of necessity, had to be adopted, the general practice being to insert the valve seats by screwing or expanding.

"A good valve seat must possess:—

(a) Resistance to the cutting action of high velocity gases, which in the vicinity of exhaust valve seats are considerably above a red heat.
(b) Toughness to resist the hammering action of the valves, together with retention of hardness at the operating temperature.
(c) A suitable co-efficient of thermal expansion to ensure that the seats remain tight in the head.
(d) Resistance to the marked corrosive effects of the anti-knock compound — tetra-ethyl-lead — now so generally added to the gasoline employed in high efficiency engines.

"Messrs. Armstrong-Siddeley, Limited, Coventry, after extensive trials with various alloys and with more than 10 years' experience of the problem, have found that Monel Metal meets the requirements in an exceptional manner, and have in consequence standardised this alloy for the valve seats of their air-cooled radial engines. These Monel Metal valve seats are produced by machining from either drop-forged rings or hot rolled tubing.

"The cylinder heads of both the "Leopard" and "Mongoose" aero engines of this company, it may be noted, are die cast in R. R. 53 alloy, an aluminum alloy containing about 1.3 per cent of nickel. The lightness, high heat conductivity and strength at elevated temperatures of the alloy render it particularly serviceable for this type of application."

A point not touched upon in the article, but of importance in this country, is the immunity of Monel Metal to the effects of ethyl gasoline.

Piccard's Third Attempt

EXPERIMENTS to be made at A Century of Progress Exposition this summer are expected to produce valuable data on at least two phases of the scientific study of the stratosphere. One is the practicability of transportation through the stratosphere by the rocket car or the stratoplane. Second, the cosmic ray and its effect upon human life.

Professor Auguste Piccard, Belgian scientist, will attempt a balloon ascension of from 5,000 to 7,000 feet higher than his mark of 53,152 feet over Switzerland last August. Stronger and lighter balloon and gondola equipment, together with a hydrogen capacity 25 per cent greater than employed in his previous flight, are the bases of hopes for the increased altitude.

The stronger and lighter equipment for such an undertaking are important, but every foot of added altitude multiplies the problems, according to Glenn O. Carter, New York, who during the World War was Consulting Engineer of the United States Navy Department in charge of balloon gases. Mr. Carter is now engaged in working out details of the gas and air problems in connection with the Piccard flight.

"The lifting power of balloons," says Mr. Carter, "is dependent upon the weight of atmosphere displaced by hydrogen; but we are to remember that the atmosphere changes rapidly as the balloon ascends. The principle utilized in the Piccard flights permits the balloon to start from the ground with a reserve capacity for expansion of the hydrogen so that none of the lifting gas will have to be released until very high altitudes are reached.

"By keeping down the weight of the balloon and the gondola, the lift will be increased so that extra ballast may be carried for use at the peak of the ascension.

"The purity of the hydrogen is vital in such a flight," says Mr. Carter, whose work as consulting engineer of the Linde Air Products Company is now being directed toward obtaining the best results possible for the experiments. The Linde company, which supplied the gases for the round-the-world flight of the Graf Zeppelin will furnish the hydrogen for Professor Piccard.

"Another problem in which our engineers are cooperating," said Mr. Carter, "is the provision of a reserve gas for keeping the pressure of the gondola high enough to preserve the lives of the pilot and observers. At altitudes greater than 20,000 feet, the outside air pressure is so low that the quantity of oxygen is insufficient to support life. This can be corrected by increasing the percentage of oxygen. But at altitudes of about 40,000 feet even 100 per cent oxygen would be so rarified that life could not be sustained."

The Airobot to Control United Transports

Here is the "airobot," the automatic pilot devised by the United Air Lines for the relief of its pilots. It is a small but intricate device.

THE "airobot," is an automatic pilot that actually flies an airplane. This apparatus has been perfected by the United Air Lines and equipment manufacturers after two years of secret development.

Long the goal of aeronautical engineers, the new device is claimed to be the first successful robot pilot to be developed and operated by an air line, as heretofore the stabilizing installations which have been previously tested, did not completely control a plane's flight.

By setting proper dials to project a desired course, the robot is turned on and flies the plane so effectively that the pilots can leave the cockpit for an indefinite length of time and the plane will never deviate from level flights over a specified route.

Encased in a metal box about a foot square, the apparatus causes the plane to climb to any desired altitude, to level off and to assume a predetermined course without the pilots touching the controls. The device is gyroscopically controlled and hydraulically operated. It includes automatic turn control, automatic climb and descent control and specific elevation control. So compact is the apparatus that the installation is responsible for a net increase of only thirty pounds in the plane's weight.

The automatic pilot is not designed to dispense with pilot and co-pilot in the United Air Lines planes. The "airobot" relieves the pilots of the active manipulation of the controls, conserves their energy and allows them to better study weather conditions. Pilots take-off and land planes equipped with the automatic pilot.

The automatic pilot consists of two gyroscopes, one operating on a vertical axis and the other on a horizontal axis. These are the recently developed artificial horizon and the directional gyro. The gyros control a highly perfected mechanism that causes pressure to be applied to the controls, actuating them to keep the plane on a desired course, to maintain level flight, to climb, to descend or to turn. The control is wholly automatic, and is reported to be more sensitive and more spontaneous than human pilots.

By regulating dials, the chief pilot of the plane can adjust the automatic pilot so that after the aircraft takes off, it climbs to any given altitude and straightens out on a level flight course. Practically every maneuver that the plane may be caused to perform in flight by manual action of the controls may be duplicated by the automatically-controlled aircraft.

How Altitude Affects the Temperature

WHEN the heat rays from the sun strike old Mother Earth, they raise the temperature near the ground, but the temperature effect diminishes rapidly when we gain altitude and leave this highly heated strata.

Experiments have shown that the temperature decreases with fair uniformity at the rate of 1°F. for every 280 feet of ascent. Then we reach the minimum temperature of -67°F. at about 30,000 feet, and from this point on, the temperature remains fairly constant for an indefinite distance.

This upper limit of temperature variation which occurs at the tropopause, is quite sharply defined, and the reason for this sudden halt in temperature decrease is difficult to explain.

LEVITATION—A

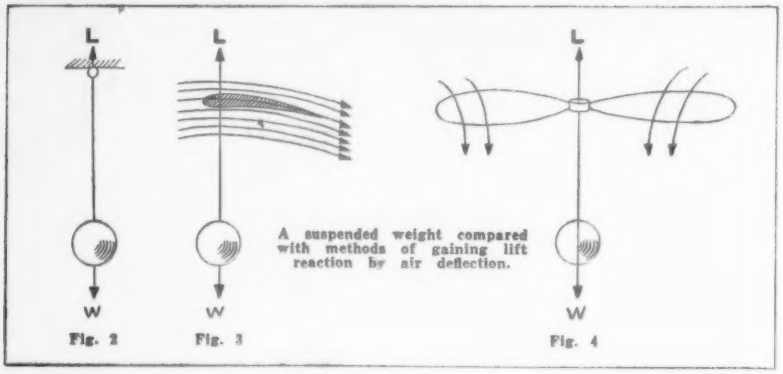


Fig. 2 Fig. 3 Fig. 4

A suspended weight compared with methods of gaining lift reaction by air deflection.

by

JOHN B. RATHBUN

LEVITATION comes just as near being the art of lifting ourselves by our boot-straps as anything can be, but on the other hand, there is just that shade of difference between boot-strapping and levitating that marks the difference between probability and improbability.

To mystify you further, before I spring the big idea on you, it can be said that the new principle of sustention has nothing to do with aeronautics or aviation, even though it does deal with the support of weight in space. Air is not essential for we can levitate bodies in a vacuum just as well as in the densest atmosphere. We simply defy gravity by an equal and opposite force produced by momentarily accelerating solid bodies. If anybody is to be blamed for this brainstorm—blame it on Newton.

When an airplane flies, it is supported by upward forces produced by the wings acting upon masses of air. The lift force is the result of hurling large masses of air downward which in turn give an upward "resultant" force. The greater the weight of air swept downward in a given time, the greater will be the weight supported. To this extent, the airplane is a levitator—but all levitators are not airplanes.

All that is necessary for the support of a body by any dynamic system is to accelerate or increase the speed of a weight in a downward direction. This accelerated mass can be air, lead, cast iron or water—it makes no difference what the weight is composed of. Since the density or weight of air varies considerably under various conditions it is not the ideal material to employ for this purpose, especially for high altitude flights where the density of the air and its effectiveness are greatly reduced.

By the use of lead weights or other solid bodies, much more compact than air, we can completely enclose the power plant within the body of the ship, thus doing away with bulky troublesome wings, control surfaces and propellers. This in turn does away with air resistance and improves the efficiency of the machine. An example of such a levitating ship is indicated in Fig. 1, a smooth streamline body without propellers, wings nor lifting screws. Simpler than the hull of a dirigible so far as outside arrangements go.

Just to get an idea of the relation between lift and weight, we show a ball suspended by a cord in Fig. 2. Gravity tends to pull the body down with a force (W) which we know as "weight." This pull is resisted, through the cord by an equal and opposite (upward) force (L) that we call the "lift." In the language of physics, the lift (L) is the "reaction" of the pull of gravity —both forces always being equal and opposite. This is the basic theory of the whole thing in a nutshell.

In the case of an airplane, (Fig. 3) the wing sweeps the air downwards as indicated by the arrow lines. This deflection of the air weight in a downward direction creates a resultant lifting force (L) which supports the weight (G).

Practically the same principle is employed with helicopters and Autogiros although the application of the principle is somewhat different. The revolving inclined blades accelerate the air downward even more directly, and the reaction once more supports the weight (W).

So much for the aeronautical side of the question which deals only with air as an accelerated body. The point to remember is that the support is due to the motion of the air and not to its solidity or viscosity. When the downward motion ceases, then support also ceases.

Now let us look into another principle of support which might be called the "difference of pressure" method. The best example of this system of levitation, and it is true levitation by the way, is the common everyday skyrocket shown by Fig. 5. The flight of the rocket is entirely independent of air reactions, hence is the best known form of a levitator. It will work in very thin air or without any air at all.

A section through a common rocket, as in Fig. 5, shows that it is a cylin-

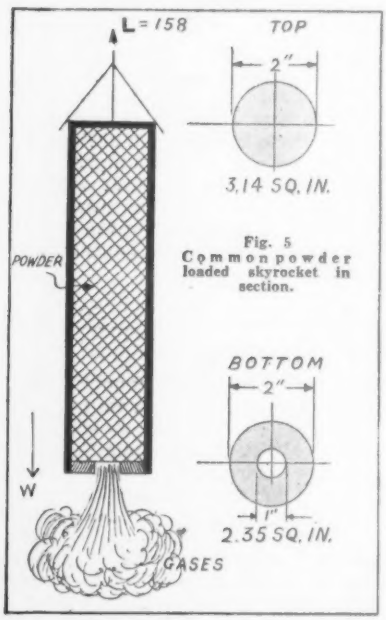


Fig. 5 Common powder loaded skyrocket in section.

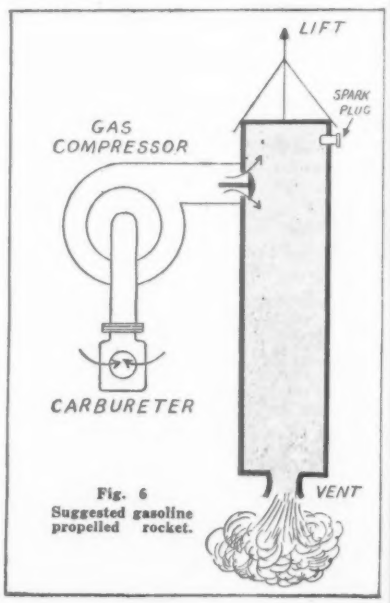


Fig. 6 Suggested gasoline propelled rocket.

A New System of Flight

HERE are suggested methods of a flight principle that is entirely independent of atmospheric support. It might possibly solve the problem of flight into the stratosphere.

So far as he knows, the principles involved are entirely original with the author and he takes pleasure in submitting these theories to our serious readers.

Fig. 1. A sketch of the proposed levitator shows that such a ship can be made of the ideal streamline form without projecting control surfaces, powerplants or similar wasteful impedimenta.

drical tube, closed at the upper end and provided with an opening or vent at the lower end through which the burned gases pass to the outer atmosphere. The burning powder creates a high pressure within the rocket which acts uniformly all over the interior surface.

Looking at the small circles to the right of the section, the top circle indicates the upper solid head, which in this case is assumed to have a diameter of 2 inches or an area of 3.14 square inches. But as the lower head has a vent opening 1 inch in diameter, the area of the bottom end is only 2.35 square inches. It is obvious, therefore, that the gas force must be greater against the top head than at the bottom since the former has the greater area, and it is this difference in force that causes the rocket to soar upwards.

Assuming that the gas pressure in the rocket is 200 pounds per square inch, the load on the top head will be, $200 \times 3.14 = 628$ pounds while the total pressure on the lower head will only be, $200 \times 2.35 = 470$ pounds. The difference between the two loads, $628 - 470 = 158$ pounds, will be the force acting against gravity that lifts the weight of the rocket and overcomes the resistance of the air in flight.

However, the flight duration of this common type rocket is limited to the amount of powder or combustible material that can be packed into the small barrel of the rocket, hence such flights will be short in length. A suggested improvement for long distance or duration flights is to revise the rocket levitator as shown by Fig. 6 where gasoline or oil vapor is used in place of powder.

The fuel in this case is a mixture of gasoline vapor with air, which is forced into the rocket by a compressor as shown. The charge is ignited periodically by a spark plug, while the burned gas rushes out of the rocket through the vent as before. The combustions will be intermittent, as it is necessary to scavenge the rocket with air between ignitions, hence a number of such rockets would be required for continuous lifting effort.

Another alternative would be to use

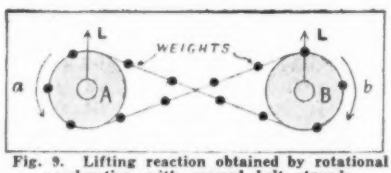


Fig. 9. Lifting reaction obtained by rotational acceleration with crossed belt strands.

a high pressure mixture supply compressor that could force in mixture continuously against the combustion pressure. By this means, the action of the rocket would be continuous as long as the compressor supplied fuel.

Having discussed the simple rocket system, we will now get back to the acceleration system which is purely a mechanical means for producing a reaction acting against gravity. A great variety of applications are possible, revolving weights, reciprocating devices, gas actuated plungers, revolving discs and a host of other schemes which might be more or less effective. The great difficulty lies in the fact that the same weights must be used over and over again and it is not always so simple nor easy to return the weights to their original positions without partly undoing the lifting effect.

Such mechanisms could be driven by any sort of an engine or could be incorporated within the engine itself, and since bearing friction would constitute the only loss, the efficiency would be of a very high order.

One of the first methods to suggest itself is to employ the forces developed by an unbalanced revolving weight. Everyone realizes the tremendous jumping and lifting forces that exist with an unbalanced flywheel or other "lopsided" revolving member. Engines, with only a few pounds unbalance in their flywheels or propellers are frequently torn loose from their foundations by the terrific forces. Bolts are also torn out or sheared that are perfectly able to carry the normal flying load of the plane.

One of the simplest applications of this principle is shown by Fig. 7 where two unbalanced iron balls, mounted on sliding arms, revolve rapidly about the shaft center. The downward moving weight (B) is farther out (at a radius of 5 units) than the weight (A) (at 3 units of length). Hence the downward acceleration of (B) will be greater than (A) and a lifting force (L) will result.

When (A) comes into the position now occupied by (B), the same thing will be repeated since the weights are moved back and forth along the arms

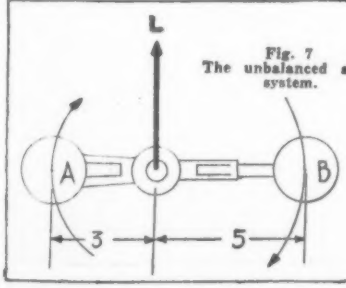


Fig. 7
The unbalanced arm system.

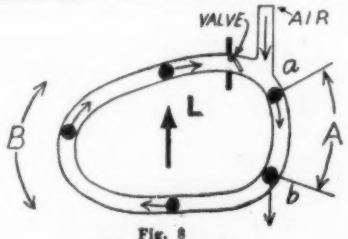


Fig. 8
Explosion track.

by a lever or cam motion. When near the top and bottom of the circle both balls are at the same distance of 4 units from the center and therefore produce no unbalanced forces. However, if slightly unbalanced at the latter position, they can be made to provide a horizontal propelling force as well as a lifting force.

In Fig. 8 is a system in which a series of small balls travel through a tube, propelled by air or steam. The track of tubing is so arranged that the balls are accelerated to a high velocity very quickly while in the short vertical portion (A) of the track, thus producing an upward resultant or lifting force. The remaining three-fourths of the time is taken in returning to the starting point, and as the velocity is very low during this period, there will be no conflicting downward forces developed. Between (a) and (b) the

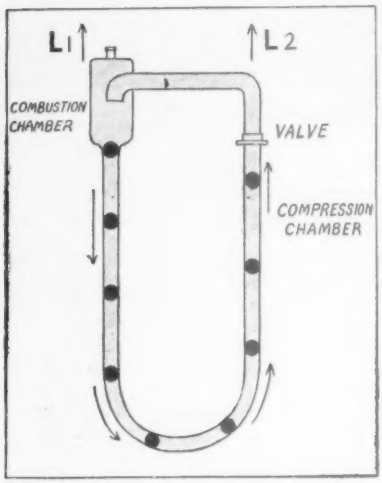


Fig. 10. A double acting explosion track device that gives two impulses per explosion. Means for scavenging waste gases are not shown.

motion is very rapid so as to get the necessary reaction.

Another but simpler scheme is that of Fig. 9 in which ball weights are carried by a crossed belt running over the two pulleys (A) and (B). Each weight descends very quickly through the short vertical arcs (a) and (b) and returns very slowly along the straight slanting portions of the belt. The result is a double lift reaction (L-L). It is the sudden acceleration at (a) and (b) that creates the force. This method has the virtue of being balanced horizontally to any degree that we may wish, thus permitting us to bring the ship to rest or give it a high horizontal velocity by the use of expanding wheels or cones.

It should be noted that only a sudden increase in speed, known as "acceleration," produces a reaction. Balls or weights running at a uniform speed, as along the straight belt strands of Fig. 9, produce no reaction whatever. A short quick acceleration downward

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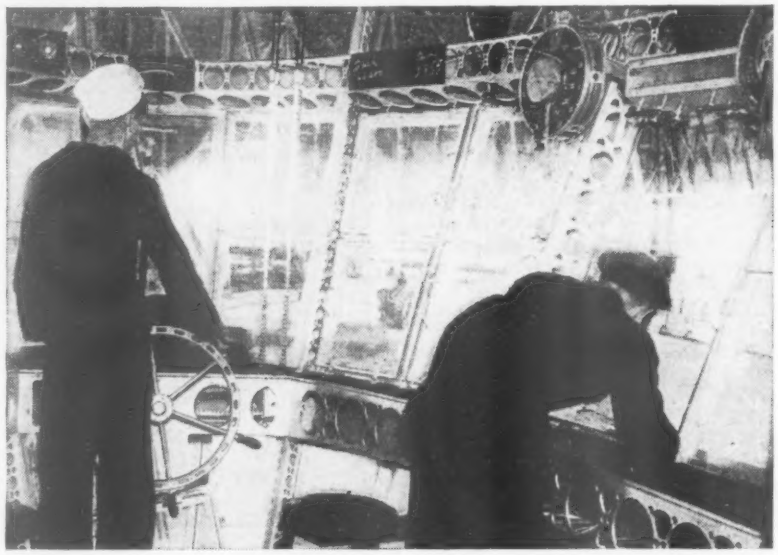
Interior of the Macon's Control Car



View from the control station of the U. S. S. Macon, Note the navigating instruments and the complex girders.

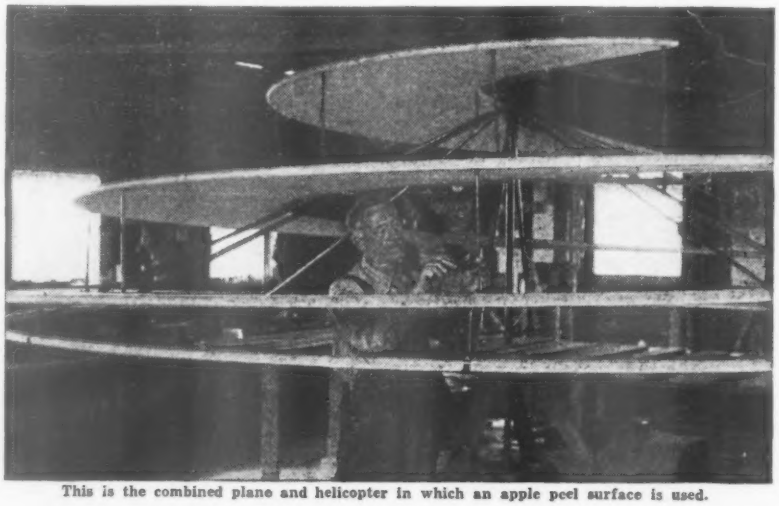
THE latest in avigation equipment is to be found in the control car of the U. S. S. Macon, the Navy's latest dirigible. The accompanying interior view of the forward portion of the control car shows a portion of the navigating instruments used.

At the upper right are the engine telegraph signals, similar in many respects to those used on marine vessels. The sailor steersman controls the directional movement in a horizontal plane while the officer at the right is taking readings through a drift indicator. It is interesting to note the design and extreme lightness of the girders, beams and struts. Millions of rivets have been employed in this construction.

A Machine With a Folding Helix

J. P. SELLMER, Stinson Beach, Calif., has devised a new sort of helicopter, or rather a Plano-helicopter, that is intended to rise and land vertically by the assistance of a screw and thereafter to fly after the manner of a conventional airplane.

The helical screw in this case consists of several turns of a continuous hollow screw thread having much the appearance of an apple peeling, and like the peeling, the helix is flexible so that it can be closed down flat and thus forms a solid circular surface. It will be seen that when this helical screw is rotated that it will exert a lifting effort, and when it is folded down flat, it can be used like a normal wing.



This is the combined plane and helicopter in which an apple peel surface is used.

Notes on Airport Etiquette

by HERB WELLS

At the airport, as everywhere else, courtesy pays. Here are a few simple rules that are real safety factors in addition to being a guide to good conduct. Don't be an airport pest—there are plenty of them now.

I CANNOT, due to limitations of space and flying ability, hope to give a one lesson flying course, nor can I hope to give any new advice to old-timers. My humble efforts are directed toward the student, the beginner and the lightplane fan. The writer is an active member in all of the above classes. Below are a few rules that are the combined results of the writer's own experience, Army Flying Regulations and the experience of many seasoned military and civilian pilots.

I. ON THE GROUND

1. Always call "CONTACT" and "SWITCH-IS-OFF" loud enough for those around you to hear. Get in the habit of doing this even if you are alone.

2. In using the hand inertia starter always wait for the command CLEAR before closing the switches.

3. Never leave a ship while the motor is running.

4. In flying a strange ship for the first time, make sure you are familiar with all the controls and instruments. Don't be ashamed to take a check ride nor to write the cruising R. P. M., oil pressure and temperature on a slip of paper and attach it to the instrument panel where you can see it.

5. Warm up your motor slowly. Be sure that the oil is at the proper temperature before taking off. You will see this rule pasted inside every Army airplane.

6. Taxi slowly and with some regard for those around you. Don't hold the stick all the way back, you are supposed to be a pilot and not a truck driver.

7. Use all the field. It may take a few seconds longer to taxi down there but it will give a chance to clear any boundary fences. Anyway, it's a good habit.

8. Use full throttle from the beginning of the take-off. You will need that speed some day. Don't go half the length of the field at half or three-quarters throttle before opening up.

II. IN THE AIR.

1. Make your climb shallow and straight as far as possible. Don't try to clear an obstacle, make a gentle climbing turn to avoid it.

2. Don't wait until you are a thousand feet up before easing back on the throttle. Make your climb at about 100 r.p.m. faster than the normal cruising speed. You will save your motor and climb faster.

3. When you have reached the desired altitude, throttle down to cruising speed. Don't strain your motor unnecessarily.

4. Use your instruments. If everything is not O. K. don't wait for it to happen to you. Come down before the low oil pressure manifests itself in an engine failure.

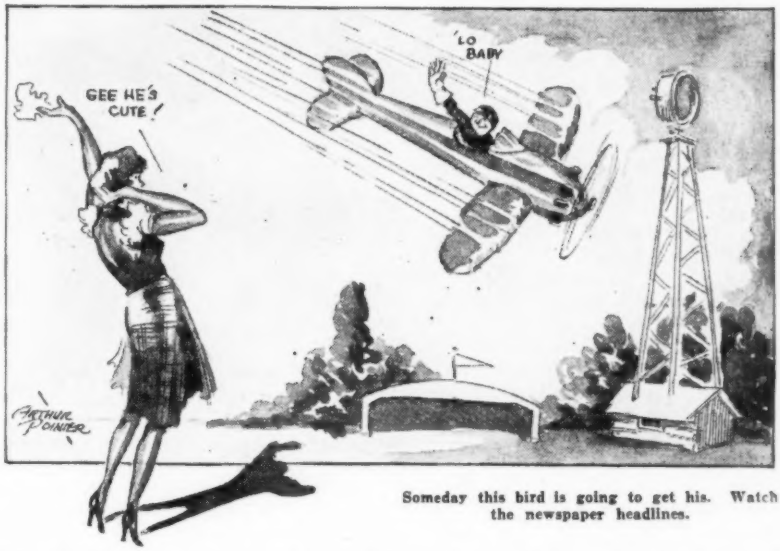
5. KEEP YOUR EYES OPEN! Look around you while flying. Always look behind you before turning. If you are going to try any aerobatics, make sure that the air is clear below. Don't spin or dive into a cloud just for the fun of it. By the way it is always a good idea to "ess" your ship on the ground before taking-off. You never can tell who might be in your blind spot.

6. Look out for other ships. Some ships are blind in rear. Remember that most small mail and military ships are always coming out of nowhere and going like the very devil. Quite often they can't see you.

7. Keep clear of commercial ships. Even though you might have the right of way, the commercial pilot has the safety of his passengers in his hands. Give him a break.

8. Don't wait till you are almost on the ground before making up your mind about your approach. You have time to plan your approach even in the event of a forced landing. Have enough altitude for the approach you plan.

9. Make sure you have a clear field before you land. Don't land in the trail of high speed or multi-motored ships. The writer got bounced all over the air last week. A twin-motored Boeing had landed and taxied up to the



Someday this bird is going to get his. Watch the newspaper headlines.

Avoid bragging about your skill. You might be giving advice to some celebrity. And wouldn't that be embarrassing?

Don't annoy the poor mech with your yarns. He has troubles—and duties—of his own. The first duty of the airport pest is to tell stories to the mechanic.

hangar. A few seconds later I followed over his course. Just like a canoe behind an ocean liner.

10. When you are making your approach, clear your motor by opening the throttle momentarily.

11. It is better to have too much altitude and flying speed than to come in at a stall. Unless you are hot-stuff don't slip in too close to the ground. A series of gentle "esses" is better.

12. Don't be a lazy pilot in landing. If you are coming in with the ground running under you crossways, correct it. Don't hope the landing gear will stand up. Failure to use your motor when you undershoot is poor head work even if you are lucky in stretching your glide.

13. Don't let your ship swing when it is on the ground. Keep it straight. A ship is never landed till its wheels have ceased to roll.

III. YOUR SHIP IN PARTICULAR

1. Treat it like the expensive machine that it is. Don't strain it unnecessarily.

2. If you make a landing in three installments get out and look the ship over before taking off again. Be sure to tell the mechanic and the owner if it is not your own ship.

3. Don't be in too big a hurry to warm up the motor. And for Pete's sake don't run it at full throttle for ten minutes just to impress the spectators.

4. Always fasten your safety belt.

5. Inspect your ship before taking off even though some one else has just finished flying it. Get in the habit of working the stick and rudder pedals before taking off.

6. Ease your ship into turns, don't snap it. It is easier on the ship and it is better flying.

7. Use your throttle. In making steep or vertical banks open the throttle slightly to help. Don't forget that the throttle is just as much a part of the control system as the stick.

IV. AROUND THE HANGAR

1. Keep out of the way. The palooka pilot is always shooting off his mouth, worrying the mechanics and disgusting the spectators.

2. You should know enough to keep clear of airplanes and propellers. Yes even dead ones. A hot motor might catch for one cough and then good-bye.

3. HANDS OFF THE OTHER FELLOW'S SHIP! Common decency should prompt you to do this. If a stranger drops in with a hot looking sport job he will probably let you go all over it if you ask him in a decent and quiet way. It is a lot better to say, "May I look in the cockpit?" than to say "I'm sorry" after you have put your foot through the wing.

4. Don't be a hangar loafer. They are a pest. There is no objection to doing a little bunk flying with the

(*Concluded on page* 140)

Lightplane Carries Gold From Mines

This lightplane is engaged in the unique pursuit of carrying gold from the mines to the assaying plant.

TRANSPORTING gold from the Itsik placer mine near Norris, Mont., to an assayer's office at Butte, is one of the numerous uses made of a little 100-horsepower sportplane belonging to Nelson Story, 3rd, Bozeman, Mont.

Approximately twice a month during the open season of the year, the precious yellow flakes washed out at the placer mine are loaded into the cockpit of the ship for a flight of more than 100 miles over Montana mountains.

The mine, which is owned by Mr. Story and his father, is located in an isolated section of the mountains a few miles from the little town of Norris. It is almost impossible to get an automobile within two miles of the place, but an open park in the timbered valley, about 200 yards below the mine, contains about fifteen acres of fairly level ground devoid of trees and this space serves fairly well as a landing field.

Formerly, it was necessary to load the flakes of gold into saddle bags and carry them a number of miles on horseback to a road accessible by automobile. The trip from the mine to Butte took almost five hours.

With the plane, the time required to transport the metal over the same route has been reduced to about one hour.

Carrying gold is but one of the many jobs that Mr. Story's sportplane does more efficiently and in much less time than would be possible by horse, automobile or train. The Storys act as distributors for an oil company at Bozeman and there are frequent business trips to be made to the main office at Butte, 100 miles away. The plane cuts hours from the time formerly required to make this trip by car or train.

In the fall, when the flight of ducks is on and the trigger finger of Nelson Story 3rd begins to itch, he hops off in his plane for a trip over the numerous lakes of the country surrounding Bozeman and finds out where the birds are most numerous and how the flight is progressing.

He has marked a number of open glades along the lake shores where he can set the ship down and when he goes out for a morning's shooting he is able to get to the lakes much quicker than other Bozeman sportsmen and be back to his work hours ahead of them. He can get to lakes that are almost inaccessible to the average hunter. He also uses the plane frequently for fishing trips during the summer.

Last spring, when the Montana National Guard, of which Mr. Story is a member, held its state encampment near Bozeman, he staged a number of dog fights for the benefit of the guardsmen with his ship representing the invading army, and another ship belonging to a sportsman pilot at Butte taking the role of the defending forces. The guardsmen still are talking about that exhibition.

Mr. Story flies his plane the year 'round. Last winter when the thermometer registered 25 degrees below zero, he wrapped the oil line with asbestos, covered up the ventilating vents in the motor cowling, and flew around unmindful of the weather. One of his favorite sports during the fall and winter is hunting coyotes by plane. The frozen surface of the lakes is used regularly for landing and taking off.

In addition to a number of trips, both business and pleasure bent, to Denver, Spokane, Cheyenne, Helena and Omaha, the Montana flier has piloted his little sportplane to the Pacific coast several times and to the National Air Races at Chicago. He says that he finds motoring unbearably nerve-racking and tedious after having become used to air travel and he seldom goes anywhere now except by plane.

Mr. Story owns his own hangar which he built for $350 and he houses his ship free of charge at the Bozeman airport.

Problems of Motor Mounting

by WALTER RALEIGH

A description of the research work recently conducted by the National Advisory Committee for Aeronautics on engine vibration and other elements concerned with the efficiency of planes and comfort of passengers on air lines.

A NEW factor—greater comfort for pilots and passengers—is now a part of the basic research program of the National Advisory Committee for Aeronautics.

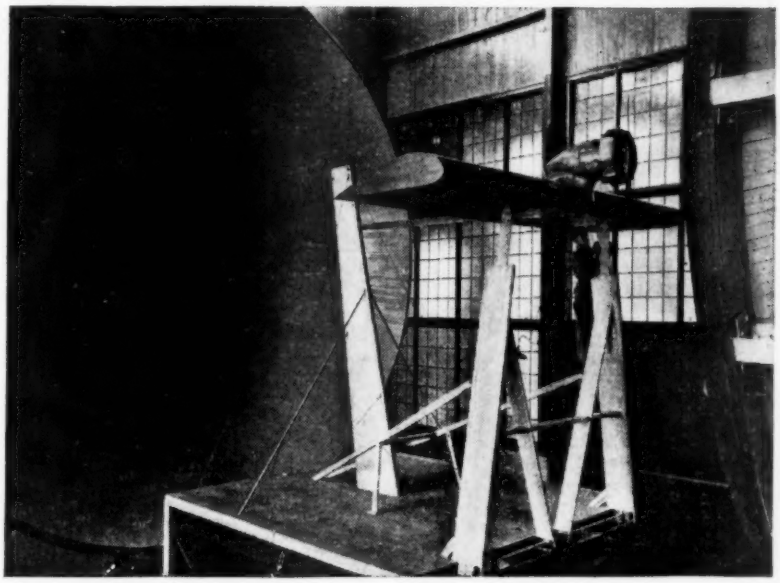
Two other factors, increased safety in flight and reduced costs, remain in that order, the primary objectives of its efforts, but the consideration it is beginning to give to comfort is almost equally significant as a direct reflection of the development of aeronautics into one of the chief transportation systems of the nation.

Dr. George W. Lewis, director of research, believes that the airplane will, more and more, become one of the most popular means of transportation and that the end of the slump will find the whole industry ready to expand in an amazing degree. Safety, economy and comfort, Dr. Lewis believes, are the elements which will round out the industry to economic success.

To this end, the Committee is seeking constantly to secure greater comfort and economy in airplane operation. The elimination of the disturbing vibrations from the propeller, engine and other noises, has come to assume chief importance. This inter-relation of objectives is found in the reduction of wind resistance of the nacelles which house the engines attached to the wings.

The results obtained in the long series of experiments and studies show that if the engine is mounted a slight distance above the wing that the influence of its nacelle on the air flowing between it and the surface of the wing produces much greater drag than when it is placed higher.

If it is hung below the wing, the drag is less than when it is in the other position and grows progressively less as the distance is increased. Again if the space between the nacelle and the wing surface is covered it is even less and the greatest reduction in drag is obtained by fitting the nacelle directly into the wing structure.



A full size wing section with a wing mounted engine under test in the giant wind-tunnel operated by the National Advisory Committee for Aeronautics.

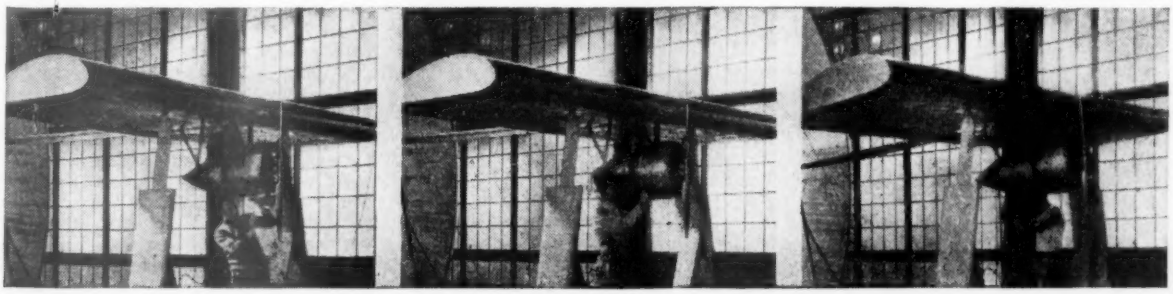
Thus, the large airplanes can be relieved of considerable weight, which in turn reduces operating costs. At the same time it is possible to give greater reserve power without increasing the rating of the engines and some of the vibration is removed with a corresponding gain in comfort.

Dr. Lewis says, "The introduction of the low-drag cowling, which reduced the head resistance of the direct air-cooled radial type engine to a point where it approached, or was less than the head resistance of the water-cooled engine and its radiator, was the result of investigations at Langley Field."

"In the further improvements of the design of aircraft more knowledge is essential regarding maximum air loads and air-load distribution on airplane construction, more information on methods of reducing drag and in particular on the proper location of power plants for minimum interference and the greatest improvement in propulsive efficiency," says Dr. Lewis.

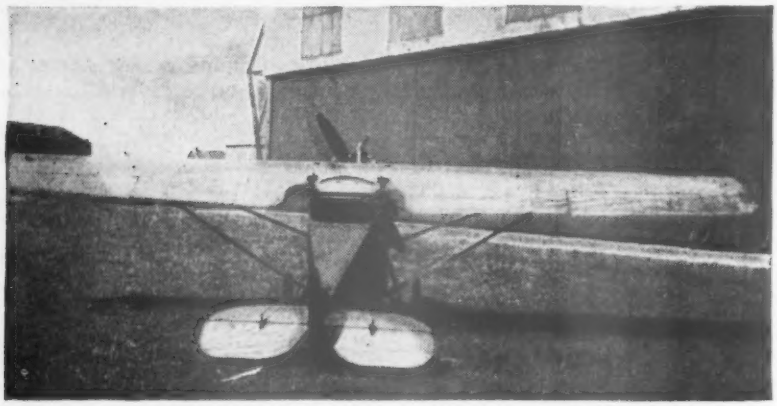
"The solution of the problem of increase in safety will come from an intensive study of spinning, low-speed control and stability characteristics of aircraft.

"Another group of almost equal importance is concerned with problems of aerodynamic improvement by the reduction of drag. A third group is concerned with problems relating to general design and operation, such as landing and taking off, local loading on wings, propeller characteristics and the prevention of ice formation."



Three progressive views of an underslung wing engine under test for factors affecting vibration, etc. Various alterations in the suspension and housing are made until vibration and resistance are at a minimum.

A Homebuilt Plane From Belgium



This Belgian lightplane has an unusually roomy cockpit.

A PILOT of the Belgian Army Air Corps—the adjutant-aviator Kreit—has just made his first flight test in a lightplane that he has built for his personal use. All of the construction was carried out in a makeshift workshop by the builder himself assisted by one workman.

The construction of this machine cost 3000 hours work, only working when off duty and with his savings from his salary of flight under officer.

The aircraft, designed and built by Mr. A. Kreit, is a high-wing single-seater, semi-cantilever monoplane, powered with an Anzani 3-cylinder air-cooled radial engine. This motor develops 35 H. P. at 1500 R. P. M. at sea-level. The wing itself, moderately thick, is of wood construction covered with plywood and is built in one piece.

The fuselage is an all-wood construction with steel connections. The front part of the fuselage is ply-wood covered while the rear part covering is of fabric. The cockpit is very large, roomy and comfortable. The fuselage arrangement provides the best possible vision for pilot.

The tail surfaces are small, but sufficiently powerful for this little plane. The stabilizer is adjustable and all the tail surfaces are built of wood covered with ply-wood.

The landing gear is of conventional axle-type, with Sandow shock-absorbers. The tail skid is of the steel spring-type.

SPECIFICATIONS

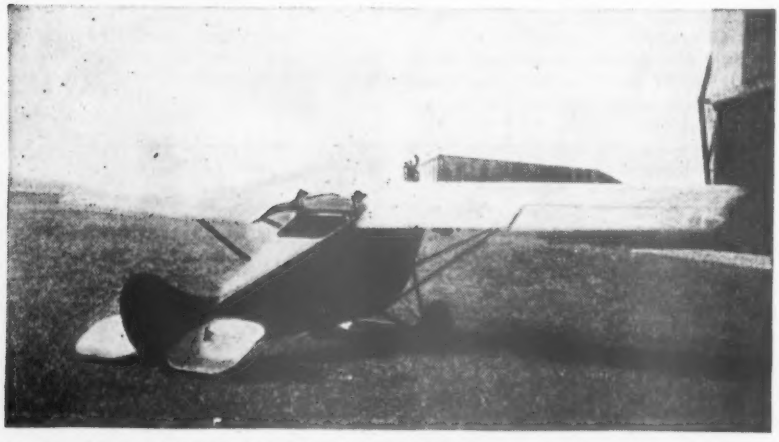
Span	22 ft. 4 in.	Fin Area	1.2 sq. ft.
Length	13 ft. 9 in.	Elevator Area	4.8 sq. ft.
Height	5 ft. 3 in.	Rudder	3.7 sq. ft.
Wing Area	64 sq. ft.		per sq. ft.
Aileron Area	9.6 sq. ft.	Wing loading	10.4 lbs.
Weight empty	473 lbs.		sq. ft.
Gross weight	672 lbs.	Power loading	19.1 lbs.
Stabilizer Area	5.9 sq. ft.		sq. ft.

PERFORMANCE

High speed	100 m.p.h.	Cruising speed	84.3 m.p.h.
Stalling speed	50 m.p.h.	Ceiling	9,836 feet

This ship is stable in flight. It can be trimmed for any speed in its flight range and can be flown "hands off" indefinitely. The take-off run is long and the rate of climb is slow, this being explained by a heavy wing loading, together with an equally heavy power loading.

We believe that this machine will be of interest to our homebuilders as evidence of what is being done in Europe with lightplanes.



The deep fuselage of the Kreit lightplane has a marked effect upon the reduction of the landing gear strut length.

Check Pilots on Airlines

A MECHANICAL "check pilot" is sent regularly over the various lines of American Airways to give the general operations manager accurate information on the treatment accorded the engines of the company's planes. From that information he deducts accurately the performance of his ground crews and pilots.

A simple device, the tachometer, merely records the speed of the engine at every moment for a period of twenty-four hours on a tape. Every variation of engine speed is indicated and by comparing these variations with the schedule of the flight, the operations manager can study many important bits of information and can even make a guess at what altitude the plane was flying at any given point.

He knows positively how long the engine was warmed and at what speeds, before the initial take-off of the day. He can tell if it was left idling on the ground at the various stops, and if the pilot operated it at a safe speed during the flight.

With the information gained from the tape, the operations manager is not only able to check the every-day discretion of his pilots while at the controls of the plane, but has also been able to ascertain the cause of fuel wastage at some stations.

News From the Sky

A SPEEDING airplane passing over the fire lookout station on Frazier Peak, Lebec, California, provides the only contact with the outside world. Miles away from the nearest railroad and highway, the lonely lookout receives the news of the world direct from the sky.

The lookout is A. L. Ellis and the engineer on the flying craft is Jess Hart. Twice daily Hart roars over the tiny cabin perched on the mountain and each time a daily paper is dropped to the waiting Ellis. Flying southward, Hart drops a San Francisco paper and on his way back north, delivers the Los Angeles daily.

Pilot Hart recently received a lengthy letter from the grateful Ellis, describing the thrill of seeing the mail plane flying across the mountain peak.

Balloon Hunting Rewards

UNCLE SAM is sending his valuable meteorological instruments into the air and is offering $5 for their safe return.

V. E. Jackl, meteorologist at the Airway Weather Bureau at Omaha, Nebraska, is conducting an interesting experiment which will benefit both the Government and native Omahans.

At regular intervals, small balloons are sent aloft from the Bureau. Attached to each balloon are small aerometeorographs to record humidity, temperature and pressure. When the ten-mile mark has been reached the bags burst and tiny red parachutes carry the record safely to earth.

Meet Me at the Air Show

by GEORGE R. GUTHRIE

Walking in and about the great Air Show building at the Chicago Century of Progress is both an interesting and educational pastime for the aero fan.

THERE have been airshows and airshows but outstanding in original features among all of the exhibitions promoted so far, is the Air Show at the Century of Progress, Chicago. It is a real treat for the air-minded because the display has a real historical interest in addition to its showing of ultra-modern 1933 models.

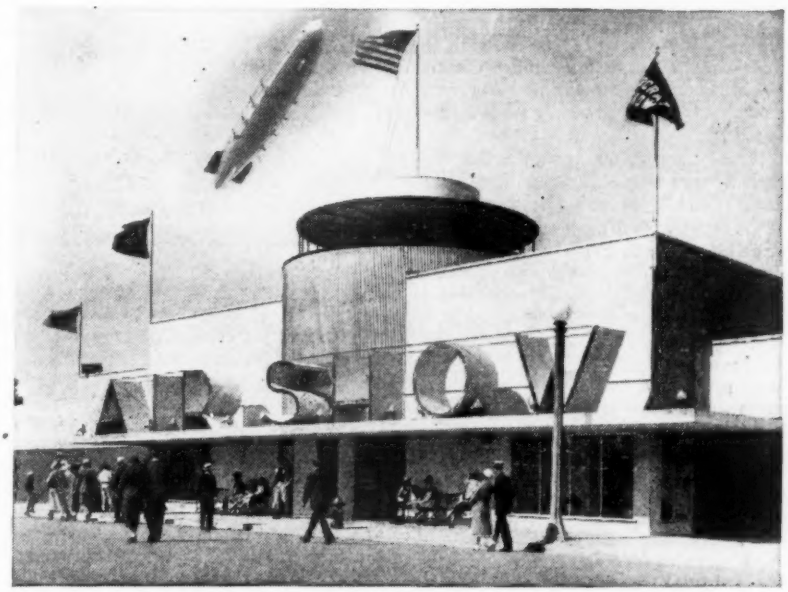
Prewar planes, wartime planes and the latest military and commercial airplanes are literally crammed into the spacious Air Show Building, which by the way, is located near the Travel and Transport Building at the Thirty-First Street entrance to the grounds. It is a real show that we heartily recommend to our readers who intend visiting the Century of Progress this summer, no matter what branch of aviation they may be interested in.

Then, in addition to the airplanes themselves is a comprehensive exhibit of models, airplane engines and all descriptions of aeronautical accessories and gadgets. And what is more, all of the exhibits are so placed that you can examine them leisurely at close range which is a feature of particular value to our air fans. Last, but not least, is the POPULAR AVIATION booth where we hope to meet our readers and thus establish a closer contact with them.

Starting at the beginning, historically speaking, are a number of prewar and World War planes that should be of particular interest to our Photo Phans. These old timers have been dug up all over the country, from haymows, basements and wood-sheds, and while not beautiful, they are strictly authentic. They show all the earmarks of a ripe old age, oil streaked, dusty and rusty.

Suspended from the low ceiling is a genuine old Model "R" Wright biplane, the very same ship used on the first transcontinental flight by Cal Rodgers. It was fully as famous in its day as the Doolittle transcontinental ships are today. Its fabric is limp and stained, but here she is, all set up for you to ponder over, just as she stood some 22 years ago.

Only a short distance from the Wright ship is a genuine Bleriot XI, the old "Cross-Channel" monoplane that was the first to complete the 28 mile flight across the English Channel. This ship is further celebrated for the fact that it was the first airplane in which modern type "stick-control" was employed. As a contrast, the latest type Pitcairn Autogiro stands beneath the old Bleriot, brand new and resplendant in its red and white paint.



Here we are at the Air Show building watching the U. S. S. Macon floating overhead as it did on its recent trip to Chicago. This building is well adapted to the display of aircraft and is centrally located on the exhibition grounds.

Walking a few feet down the hall we see another old-timer hanging from the ceiling—Walter Brock's famous old Morane monoplane with which he won the London-Paris race so many years ago. This is in by far the best condition of all the old-timers, and with very little work could be put into flying condition. It is really a beautiful little monoplane, even when judged according to present day standards.

We haven't the space to recount all of the old planes, but among them are a Baldwin Red-Devil and the first contract mailplane—a single pontoon hydroplane built by Curtiss and used in 1910 by Al Engel. All of them flew and all of them contributed to the airplane of today.

World warplanes are well represented by several exhibits. First, there is a two-seater Nieuport in a good state of preservation. Standing close by the Nieuport is a wartime Sopwith "Snipe" and several other ships of this period, not overlooking an old Jennie and a Thomas-Morse scoutplane. The latter is in excellent condition, in fact it was flown with its original LeRhone engine, just before sending it to the show. The Tommy is a beautiful little biplane of strikingly modern appearance, and with a little cleaning up should be able to scoot around the pylons with the best of modern ships in its class.

Lightplanes of the present day are represented by an Aeronca and a Taylor Cub, both of which are direct from the factory. Possibly more of this class will appear at a later date. The scanty lightplane exhibit is the only weak spot in the show.

Getting down to the modern ships on display, there are numerous excellent examples of both commercial and military types. For example, there is a huge Bellanca "Airbus" and the speedy little Boeing P-26 single-seater monoplane loaned by the U. S. Army Air Corps together with several other up-to-the minute American military types. With this government exhibit is further material in the way of airplane equipment, aero engines and what not. This, alone, is well worth the visit to the show.

Then, model fans, we arrive at the airplane model exhibit which is very complete and representative of the latest dope in model building. Many of the more prominent model companies are present and display their products, which are certain to be of interest to our model builders. The models range all the way from tiny scale replicas to large flying models of all sizes and descriptions.

Right in the midst of the model section will be found the display featured by POPULAR AVIATION where the con-

(*Continued on page* 129)

The Akron Memorial Cachet

STAMP enthusiasts over the country will be interested in the Akron Memorial cachet, commemorating the U. S. S. Akron disaster, which was mailed to thousands of philatelists with the postmark Lakehurst, New Jersey.

Only 40 originals of the cachet were made. Thirty-four of these were addressed to members of the Lakewood Stamp Society which got out the cachet, the remainder were sent to President Roosevelt, Lieut. Commander Charles E. Rosendahl, Commander Alger H. Dresel, President Paul W. Litchfield of Goodyear Zeppelin and others.

More than 3,000 requests for this cachet were received from stamp collectors in all parts of the country.

The cachet was designed by Edward Bedell, Lakewood art student. It shows the Akron in flight with storm clouds gathering behind her. At one side is the J3, the blimp which was destroyed in the search for the Akron.

Above the airships is a streamer bearing the words, "In Memoriam" and at the sides the words, "To the lives lost in the Akron disaster."

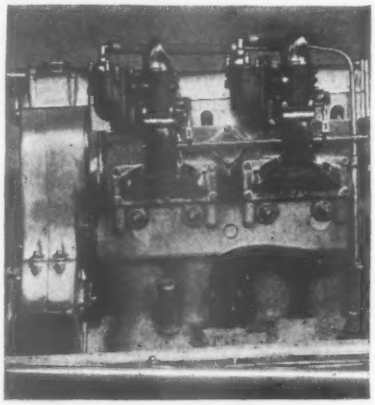
Any collector who succeeds adding this memorial cachet to his collection will indeed be fortunate, because with only 40 original copies in existence, the prices will soar after a few years, perhaps reaching several hundred dollars. The autographed cachets will be almost priceless, for autographed airmail covers or cachets of any kind have always brought their price.

Richard Deal, one of the survivors of the Akron, was present at a meeting of the stamp society and autographed the original cachets which were sent to President Roosevelt and others.

Several of the members of the Lakewood stamp club lost relatives aboard the Akron, and it was quite fitting that they should be the originators of this cachet.

This reproduction of the Akron Memorial Cachet depicts the disaster that overtook the huge dirigible. Note the menacing storm clouds in the background.

Improved Valve Cooling Method



Cylinders of the Smith Engine.

IT has long been recognized that proper valve cooling is one of the most important factors in the design of engines and particularly with air-cooled aeronautic engines where it is quite difficult to properly remove the heat from around the valves.

In an engine recently invented by T. Noah Smith, an ingenious rearrangement of the valves very greatly assists not only the cooling but improves the engine operation in general. Effectively this is attained by using one valve for both inlet and exhaust which is quite contrary to usual practice. It is said that this new valve system is simpler than the usual system and that a considerable amount of weight is saved.

It is interesting to note that when the water-cooled test engine was run in a racing car that not sufficient heat was developed to allow the proper operation of the carbureter. Thereupon, the radiator was drained of all water and a run of five miles was made at a speed of 80 m.p.h. with the cooling system entirely out of commission. No overheating was noted and the engine ran perfectly from that time on without water.

Biplanes Exceed Monoplanes

ACCORDING to the May issue of *Parks Air News*, the number of biplanes in the United States exceeds the number of monoplanes by a good big percentage, and what is more, the percentage of biplanes is continually increasing. We quote this article in its entirety.

"Monoplane or biplane? Manufacturers for years have advanced the merits of that type favored by each.

"Recent figures show that in 1929, 60% of all airplanes built were biplanes. In 1930, this dropped to 55% and in 1931 it dropped to 34%, due probably to the invasion of lightplanes, most of which were of the monoplane type.

"In 1932, the percentage of biplanes to the total production was 49% and in January of this year it was 70%.

Livestock by Air

SURELY when the day has arrived that live stock is shipped by air then all question as to the practical value of aviation is settled! And live stock is being shipped by air express regularly over the Pan American Airways to points in countries to the south of the United States.

Fish fanciers of Latin America have long wanted to breed certain species of gold fish but it has not been practical to bring them in from the United States. When they travel by steamboat the fish usually die or acquire the infirmities of old age before they arrive at their destination.

Jose M. Arias of San Jose, C. R. decided to import his finny pets and have them brought in by air. W. Trickor & Co. of Saddle River, N. J. expressed 19 pounds of them via air express to Senior Arias. Arriving in Miami, Florida, they were transferred to a Pan American air liner and departed thence for Costa Rica, via Havana and Central America.

Leaving New Jersey on July 24th they arrived at San Jose on the 29th. So quickly was the trip made that these fancy gold fish required neither food nor change of water while in transit.

Fancy gold fish are not the only live stock sent via air express over the Pan American Airways. For some time each week four million "bugs" have been carried from Peru to Louisiana, through Miami. These bugs are enemies of the sugar cane parasite and the planters in Louisiana are welcoming their importation into this country.

Would you call hatching eggs "live stock"? A shipment of extra fine hatching eggs was forwarded from Miami to British Guiana via the airline express. They could not have been forwarded any other way and reached their destination in condition for hatching.

Caught in the Act

AN ALERT cameraman caught this English seaplane in the act of dropping its torpedo during practice. From this, it will be seen, that the torpedo plane is a formidable weapon in naval operations.

The Blackburn-Napier torpedo plane.

Last Call for L. A. A. Members

by O. G. CORBEN

September 1, 1933, is the dead-line for memberships in the L. A. A. If we do not receive 500 members by this date, then all further efforts at organizing will be abandoned and dues refunded.

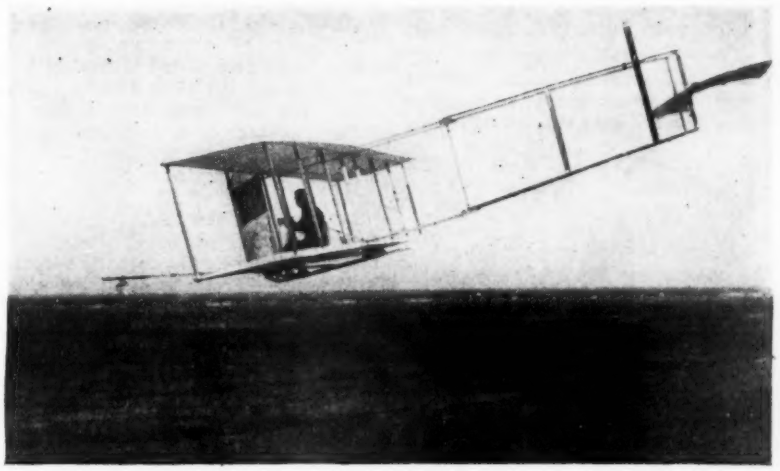
AFTER reading the article in the June issue of POPULAR AVIATION written by Mr. Les Long, I will say that Mr. Long has brought out some very interesting facts for the "fledgelings" who have had their wings clipped by some of these new state laws which seem to be springing up all over the country for no apparent reason at all. Maybe there is a reason behind them but it certainly is not to the advantage of the amateur flyer.

The fact that I am connected not only with the manufacturing end of the aircraft game but also operate a large commercial field at Madison, Wis., places me in a position to look at the matter from several different angles and I can not see any just reason why the amateurs should be held down under the foot of some state law and their ambitions dampened. After all, the amateur flyers of today will be the pilots of tomorrow and they should be helped instead of discouraged.

I am very pleased to bring out the attitude of our State, Wisconsin, regarding private flying for I really feel that we have a very conservative lot of law makers here and the steps they have taken are well worth bringing to your attention. Several years ago, when aviation was going forward by leaps and bounds and before the Department of Commerce came into the picture, it was quite apparent that something would have to be done in order to protect the average person who knew little of flying or aircraft. Therefore, the State of Wisconsin passed a law requiring that all aircraft operating in this State be inspected by a state inspector, who upon finding them airworthy would issue a state license.

However, about the time this law was completed, the Department of Commerce became active and placed a number of capable inspectors all over the country to govern air commerce in general. Knowing the Department of Commerce was by far better equipped to take care of all air-worthiness requirements than they were, the State of Wisconsin forgot about their old law and were content to rely upon the requirements of the Department of Commerce to govern aerial activity in this State.

This act has saved the State the expense of having its own aeronautical department and I believe that the number of accidents here have not exceeded those of states that have felt the unlicensed ship was such a hazard. In boosting, as to what our State has done, I do not want to impress you this is the only state which has taken a sensible view point upon the matter of aerial operations within its bounds for there are a few other states that have taken into consideration the experience of the Department of Commerce and adopted the federal rules applying to aircraft.



This picture of an early Wright glider shows what progress can be made by amateurs when they are not hampered by restrictive legislation. The Wrights were amateurs and experimenters that lived in a free and enlightened age.

It is a man size job to handle the flying activities and the Department of Commerce is to be given credit for their work to date. I have talked with several young men throughout the country who feel the Department of Commerce has done a lot to prevent them from flying, but this is not true.

The Department of Commerce does not say you cannot fly. For all they care, you can put an old OX-5 on a baby cart and build up some kind of wings and try to fly it. Naturally, they would not encourage such a thing, neither would any other sensible person or group.

It has been my experience, that all of the personnel of the Department of Commerce forms a very helpful bunch and as a whole I have found they do not have any grudge against the amateur builder or flyer. In turn, the amateur should look to the Department for guidance and I personally believe that you will reach your goal much quicker.

Now to get back to the L. A. A. POPULAR AVIATION is offering to its readers a very great service by forming this organization and it seems to me that there should be more cooperation among the young men than has been shown to date. This is your chance to make your wants known so why not get busy and send in your membership? POPULAR AVIATION has secured the cooperation of some of the best and most experienced builders as a committee to try and help the amateur flyer who is grounded by some of the state laws, and each have shown their desire to help you but it is up to each of you to do your part. Just because your state has not yet clamped down on home-built planes your problems are not at an end. There may be a time when you would like to fly to some other state which says, "all ships

POPULAR AVIATION,
608 So. Dearborn St.,
Chicago, Ill.

PRESENT MEMBERSHIP 203
297 yet to go to reach 500
Sign up today!

Gentlemen:

I enclose one dollar ($1.00) herewith for one year's membership dues in the lightplane association now being organized.

NAME.....

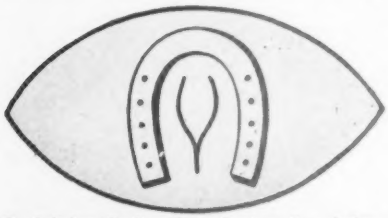
STREET OR R. F. D.....

CITY.....STATE.....

must be licensed," so think it over. Do you want to fly or not?

Mr. Les Long has given you some very good ideas as to how the whole thing should be handled. However, I believe that trying to get each state to change its laws would be an endless job and by the time it was finished we would be too old to handle a plane. Why not try to get the Department of Commerce to issue a special license on single-place home-built ships, then you could fly where you pleased.

Already, I can see some of your faces getting long when I say single-place ships but I am sure that it will be a



Symbolizing "luck and good wishes," a design submitted by a reader.

lot easier to get a special license through on a single-place than a two-place job. As I have mentioned before, the Department of Commerce will no doubt be willing to work with us but I do not think they would favor anything but a single-place plane and I also believe the states would have the

Here is a pin design submitted by a reader, but we wonder whether there will be enough members to require a pin.

same attitude which after all is better than not building or flying at all.

What I have brought out here are only my own ideas and are offered only as a suggestion. No doubt they can be improved upon or worked out in detail before the final step is taken for any kind of action. Without your support the whole thing will be a flop and this means that those who live in some states will have to be content to watch others enjoy the sport and convenience of FLYING.

EDITOR'S NOTE: *Mr. Corben's letter is well taken, for it suggests a means of simplifying the procedure in attacking the legislative problem. However, we are still waiting for a solution to our greatest problem, and that is some means of collecting 500 members in good standing. We are starting to have the fidgets at this late date and we wonder—and wonder.*

QUESTION AND ANSWER DEPARTMENT

All questions of general interest on any phase of aviation will be answered authoritatively by POPULAR AVIATION's Technical Staff.

QUESTION:—Fred S. Butler, Amsterdam, N. Y. *What is the American equivalent for 100 km/hr, and how many miles per hour is equal to one knot per hour?*

Answer:—SINCE one kilometer is approximately 0.6 of one mile, a speed of 100 kilometers per hour is equal to: $100 \times 0.6 = 60$ m.p.h. Knots are not distances but speeds, hence we refer to a ship making 50 knots—not 50 knots per hour. A knot is equal to approximately 1.15 m.p.h.

* * *

QUESTION:—John A. Kellar, La-Crosse, Wis. *Is the angle of incidence the same thing as the angle of attack?*

Answer:—THE angle of incidence is a fixed wing angle built into the ship and usually is the angle made by the chord of the wing and the centerline of thrust. The angle of attack, on the other hand, is the angle made by the wing chord with the direction of the air stream.

* * *

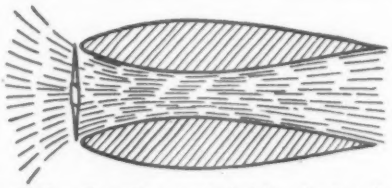
QUESTION:—Allen French, Bloomington, Ill. *What is an orthogonal wing cell? I understand that this is applied to biplanes.*

Answer:—AN orthogonal biplane is one in which equal upper and lower wings lie on the same vertical line. If the leading edge of the upper wing is ahead of the lower wing, the cell is said to have "positive stagger." If the lower wing is ahead of the upper, then the cell has negative stagger. An orthogonal cell, therefore, has "zero stagger."

* * *

QUESTION:—Harry Forbes, Sioux City, Ia. *What is a venturi propeller guide and what is its purpose? Is this the same thing as a venturi tube?*

Answer:—A VENTURI tube has a curved bore of parabolic form that governs the flow of air. In such a tube, the velocity of the stream is the same all across its section which is not the case with a straight bore tube. When used to guide the slip-stream from a propeller, the slip stream section is uniform and the



Section through a venturi tube showing its effect on an air column.

efficiency of the propeller is much improved. This principle was applied successfully to the Italian "barrel plane."

* * *

QUESTION:—James Knoehrle, Baltimore, Md. *My engine does not develop quite enough power to fly my light-plane successfully. Is it possible to add some sort of chemical to the gasoline to give more power?*

Answer:—PICRIC acid, camphor gum, acetylene gas or phenothalein all increase the amount of power obtainable from gasoline, but all of them are injurious to the engine, particularly the picric acid.

* * *

QUESTION:—A. L. Henderson, Cedar Rapids, Ia. *Which is lightest, an all metal ship or a wood framed ship?*

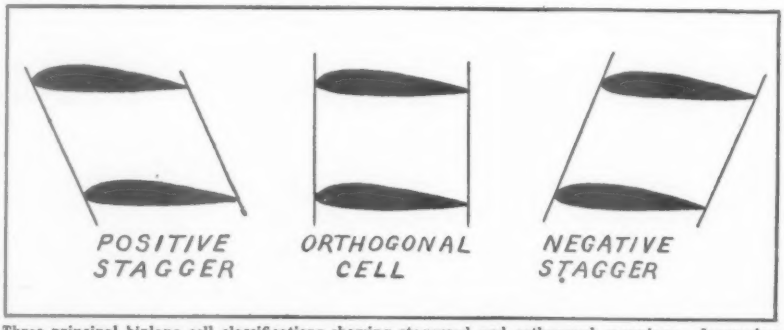
Answer:—USING ordinary carbon steel tubing, a steel plane is considerably heavier than the equivalent plane built up of spruce members. Even with the most expensive alloyed steels, there is still a marked difference in favor of wood. Spruce is, for a given strength, the lightest material known.

* * *

QUESTION:—Harley W. Andrews, Tampa, Fla. *I know from personal experience that water boils at a lower temperature at high altitudes than near the ground, but can an elevation be reached at which it will boil at 100° F. or lower?*

Answer:—YES. Water boils at 100° F. at approximately 55,000 feet. Due to the decreasing pressure it will boil at still lower

(*Continued on page* 133)



Three principal biplane cell classifications showing staggered and orthogonal groupings. Increasing the incidence angle of the lower wing is called "positive decalage" while "negative decalage" is the condition under which the incidence of the upper wing is greatest.

More About Steam Planes

by A. N. NICKERSON

One of our steam engine fans takes up the case of the steam engine in considerable detail and brings out several points concerning steam propulsion not mentioned in previous articles.

IN THE minds of many, when the question of steam power is mentioned, the query arises as to why steam should be considered at all, since we have such good internal combustion engines.

I say this question arises in the minds of many, but not all. Especially was this true in the early days of airplanes. There were many of us who wondered, as we read of the failures of so many planes, why steam should not be used in a situation where absolute reliability meant the difference between life and death.

There were so many who wrote into the Bureau of Aeronautics asking why this had not been done that the Bureau issued a bulletin showing how impossible it was to accomplish this. Surely, when this bulletin was prepared, its author must have forgotten that the first heavier-than-air machine flew under steam power.

The locomotive is the emblem of power, speed and reliability. I like to remember a big stationary engine I once operated which had been in service for twenty-two years with only minor repairs. It was then harnessed with a 50 per cent overload and went on silently and uncomplainingly, doing its bit for many more years.

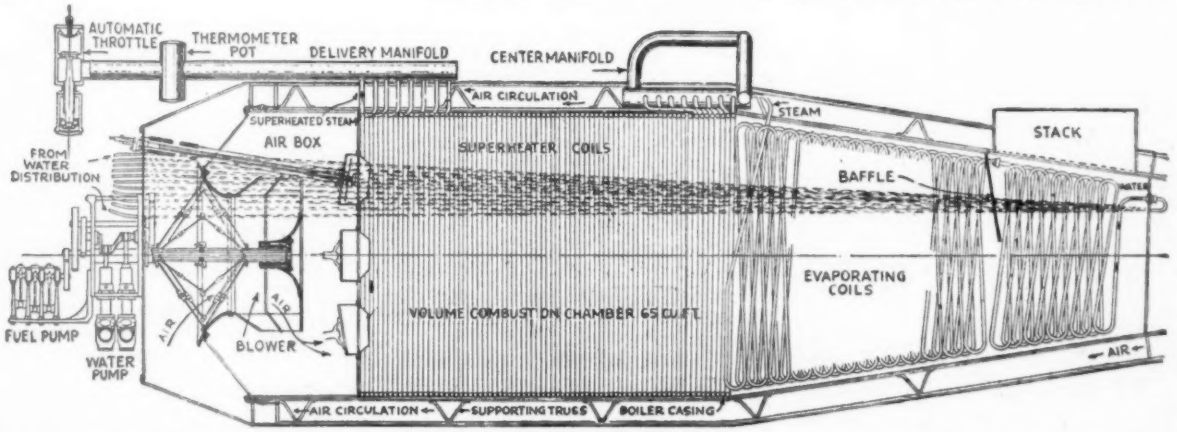
I like to recall a high speed lighting unit which ran for two years, day and night, that was never shut down, even to take up a bearing. These engines were no more fit for airplane propulsion than was the early gasoline engine, but somehow and for a good reason, we have never gotten into the habit of expecting a steam plant to fail us, whether it be in a factory, on a steamship, a locomotive, or a road roller. It always goes.

The successful Besler plane, the first full size steam propelled airplane to make a controlled flight.

But there are many other considerations and I will list them as follows: 1. Reliability. 2. Noiselessness. 3. Lack of vibration. 4. Low first cost. 5. Low maintenance cost. 6. Low depreciation. 7. Better distribution of weight. 8. Cheaper fuel. 9. Reduction of fire hazard. 10. Less lubricating oil. 11. Increase of efficiency at high altitudes. 12. Plenty of heat available for combating cold. 13. Efficiency at low engine speeds. 14. Greater acceleration. 15. Greater maneuverability.

The factors that are usually considered against the steam engine are: 1. Larger weight per horse power. 2. Greater space required. 3. The hazard of an open fire. 4. The anticipated increased liability of failure because of a more complicated plumbing system, so called. 5. The problem of carrying water. 6. The increased fuel cost.

No well built and well adjusted engine should have any noise other than that of exhaust. In the case of a gasoline engine, this noise which ordinarily resembles the discharge of a shot gun, is muffled by various means to where, in our pleasure cars, it is extremely quiet. But this muffling creates a back-pressure which means a great loss of power and as yet has not been commonly used in airplanes. Thus, the passage of an airplane through the air



This aviation steam plant outlined by the U. S. Navy, was intended to prove that steam propelled planes are not practical. Compare this plant with the compact powerful plant of the Besler plane above.

is always accompanied by a noise which may be heard for miles. A steam engine running at high speed also has a noisy exhaust, but as our airplane power-plant will necessarily have to run condensing, this exhaust will pass into a condenser where there is no connection with the outside air and consequently no noise.

Of course, all the noise in an airplane is not caused by the engine. The propellers have a tremendous snap to them at the high speed which is usually attained and which is so necessary in a propeller directly connected with the high-speed engines now in use. In connection with this, I might state that the types of internal combustion engines used in airplanes must run at high speed to be at all efficient. This speed is a variable quantity, from 1600 revolutions per minute up.

I have it from a noted authority that this is not the ideal speed for a propeller, but propellers at present must be designed to meet present engine conditions and so we have a high speed propeller with its snap and vibration. This authority, who is one of the larg est builders of propellers in the country, stated that the ideal propeller should be of large diameter and not run over 1000 revolutions per minute and that then its operation would be practically noiseless.

Generally speaking, the higher piston speed you have the more economical an engine will be, whether in steam or gasoline, but few steam engines are built today which operate at a higher piston speed than 700 or 800 feet per minute, while gasoline engines often have a piston speed of 2500 feet per minute. A steam engine with a piston speed of 1000 feet per minute, in the sizes which would be ordinarily considered as proper for an airplane, would be an extremely economical engine and would handle a large low speed propeller directly connected. It would not present anywhere near the problems in balance that the gasoline engine does, running at 1800 to 2000 R.P.M.

There need be no vibration from an engine of this sort and vibration is the thing which gives as much trouble as any one other thing. It breaks wires, snaps tubes, shakes the structure of the airplane and only the fact that it leaves the ground makes it possible to function at all.

A good internal combustion airplane engine is an expensive proposition to build. The finest materials and workmanship are necessary and our present day airplane engine is a wonderful tribute to the mechanical ingenuity of mankind in the solution of the problems inherent to the situation.

Of course, such an engine must be frequently inspected, every part must be kept in perfect condition if it is to be relied upon and continue to function efficiently and maintenance cost on this

(*Concluded on page* 131)

The Aero-Sportswomen

by JOAN THOMAS

MISS HENRIETTA SUMNER, Los Angeles, won the second annual Annette Gipson all-women air race on June 4th, over a forty-five mile course between the Floyd Bennett Field, Brooklyn, and Valley Stream. The honor also carried a cash award of $500.

Mrs. Francis Marsalis, co-holder of the women's refueling endurance record was second; Miss Jessamine Goddard was third and Mrs. Mary Moore Sanson, stunt flyer of Hartford, Conn., fourth. The prizes were $200, $100 and $50 respectively, and all of the entrants were given silver fox fur pieces.

Amelia Earhart, president of the Ninety-Nine organization, was official starter and Ruth Nichols kept score. The race was a 99 invitation affair and had the sanction of the F. A. I.

"I was tremenduously pleased with the way the entire event was conducted," Miss Earhart told the editor of this column. "It was the largest all-women race that has ever been held. There were 21 entrants. They got off in perfect order and all finished the course. There wasn't the slightest mishap to mar the whole affair.

"It was a handicap race, as you know," she continued, "the first place was won by Henrietta Summer, but the fastest time was made by Laura Ingalls, who flew her Lockheed at a top speed of 180 miles an hour."

"The race was sponsored by a private concern in New York City and I hope it may set an example and encourage other corporations, or firms in different parts of the country to do the same thing.

"For example, why doesn't some store in Chicago see the possibilities of such an event and offer similar prizes for an annual race? They would get a tremendous return in the way of advertising for a comparatively small outlay.

"We had a crowd of over 25,000 people at the Annette Gipson race, which shows the enthusiasm of the public for such a meet. And such a race means a lot to women flyers, not only in the way of publicity, but in training them before taking part in the major air meets, where they are in competition with men."

* * *

MISS EARHART, accompanied by her husband, George Palmer Putnam, her step-son 12-year-old George Jr., and Miss Betty Chester, flew to Chicago recently to attend the "Century of Progress."

"We use my plane as sort of a family bus," Miss Earhart laughingly explained. "It is not the one I used on the Atlantic flight, but it is the same kind."

They landed at the Curtiss-Reynolds

Miss Henrietta Sumner, winner of the Annette Gipson race.

airport, where the plane was left during their stay in the city. Captain Lewis A. Yancey's Pitcairn Autogiro, "Miss Champion" in which he has visited every city of the country with a population of more than 20,000 during the last two years, and with which he hopes to establish a new altitude record for Autogiros this summer, was housed in the same hangar with Miss Earhart's Lockheed.

The Putnams came to Chicago especially to see the Fair and expressed great enthusiasm for it. Amelia said she expected to be back in Chicago in September for the International air races and the Gordon Bennett balloon trophy races. She will be in Los Angeles for the national air races the first week in July. She will preside over the annual meeting of the Ninety-Nines, the official organization of women flyers, of which she is President.

* * *

WOMEN'S interest in aviation is not limited solely to flying. Mrs. Edith Descomb, who is a business partner of her flyer-husband, Charles Descomb, claims to have sold over 53,000 airplane rides in the last eight years.

The Descombs started out in the barnstorming days and now operate the Descomb Flying Service at Brainard Field, Hartford, Conn., which offers flying instruction, passenger flights and aerial advertising services.

Mrs. Descomb knows how to fly, of course. She owns her own ship, a Fairchild cabin, has had 247 solo hours and is studying navigation and meteorology for her transport test. She has won distinction as a stunt pilot and as a racing pilot. She was given the Hiram Maxim Trophy last year as the best all-round woman pilot in Connecticut.

* * *

ANOTHER woman who is connected with the industry in a business way is Mrs. Louise H. Saunders. She

(*Concluded on page* 130)

Southern Aviation News

Brief, pertinent aviation news items from the Southern airports. A new section devoted to the interests of former readers of SOUTHERN AVIATION which is now merged with POPULAR AVIATION.

Bomber is Christened

SPRINGFIELD, MO., was honored recently when Mayor Harry D. Durst christened one of the army "mystery" bombers "City of Springfield, Mo."

The ceremony, witnessed by throngs at the municipal airport, celebrated the homecoming of Lieutenant Ralph A. Snavely, squadron commander and an overnight visit by the six "mystery bombers" of the 31st bombardment squadron of the U. S. Army. A speakers' platform was improvised under the nose of the "City of Springfield."

If Lieutenant Snavely's plane had hoped for a christening bath of the new beverage, it was disappointed. As none was available at the airport, someone got a bottle of ginger ale and the mayor gripped it firmly by the neck and smacked it across the plane's nose. No results. He grasped the bottom of the bottle and rapped the neck against the plane. Still no results. He tried it once more, the cap flew off and the plane's nose was sprinkled with the contents. The bottle is ready for a refill.

In response to the mayor's address, Lieutenant Snavely said he was delighted to be home again and to see the fine municipal airport Springfield had developed. He recalled his early efforts to popularize aviation here and added that he liked to think he helped pave the way for the transport ships that now fly regularly over Springfield.

He told how the Chamber of Commerce backed aviation then with an annual contribution of $20 to rent an additional 10 acres for his field. In those early flying days he said one of his chief sources of income was salvaging army airplanes that tried to land on his flying field near Phelps Grove park.

Seaplane in Rescue Work

A NEW ORLEANS engineer, employed aboard one of the United Fruit Company's banana ships, has a seaplane and the prompt action of the United States Navy to thank for his life.

John H. Giges, third assistant engineer of the steamship Carrille, was taken seriously ill when the ship was enroute from Tela, Honduras, and approximately 200 miles out of New Orleans. There was no physician aboard the craft, but members of the crew tried to minister to the writhing man. Officers of the ship were convinced that Giges was suffering from acute appendicitis.

They sent a wireless message to the United Fruit office in the Crescent City, and officials there in turn communicated the news to Rear Admiral H. H. Cristy of New Orleans, commandant of the Eighth Naval District. He ordered a seaplane sent out of the Pensacola Naval Air Station.

Shortly after noon, the craft took off and less than three hours later it reached the fruit boat. Lieutenant W. E. Kellum, physician, one of the plane's passengers, decided that Giges should be operated on as soon as possible. The engineer was packed into the aircraft and two hours flying took him to the Crescent City, where an ambulance met him at the New Orleans Air Line's landing in the Industrial Canal.

The appendix ruptured before Giges reached the hospital, but an emergency operation proved successful. Lying in a hospital bed recuperating, the engineer repeatedly thanked his "lucky star" for a seaplane and the United States Navy. This, however, is just one of the many cases where airplanes have rendered useful service in surgical emergencies.

This is a view of one of Frakes' crashed ships. Bring on the next—he'll ride 'em.

THOSE interested in selling their old crates should get in touch with F. F. Frakes, Columbia, Tennessee.

This unusual shot was snapped recently in Nashville, Tenn., when F. F. (Bowser) Frakes, nationally known aviator, made his eighth death-daring plunge from an altitude of 3,000 feet, deliberately crashing the plane.

This hair-raising stunt will long be remembered by a crowd estimated at 30,000, who witnessed the crash.

Seventy-five policemen, aided by twenty-five deputy sheriffs and a number of state highway patrolmen and national guardsmen insured the safety of the spectators, while Webber Hall, an expert sound cameraman of Fox Movietone, recorded in motion pictures and sound, the thrilling performance, which has been shown in theatres all over the country.

Mr. Hall, who has filmed air celebrities and their widely known feats, made the following remark: "It is the most thrilling and spectacular stunt that I have filmed in my entire career. I've faced everything with the cameras, but facing the diving plane and the rending crash as it smashes is the hardest yet." Frakes crawled out unhurt!

Miami Coast Guard Has New Plane

THE Coast Guard Aviation base at Miami announced the addition of a new plane to the two already assigned to the Florida territory. The new ship is a Douglas amphibian, the "Sirius," flown to Miami from Cape May, New Jersey, by Lieutenant Commander E. F. Stone.

Laredo Airport Will Soon Be Ready

RAPID progress is being made on the municipal airport, Laredo, Tex., since city road building machinery has been put to work. The hill on the site which had been classed as a hazard, has been entirely removed and is now a portion of the leveled ground. Work on the construction of the two runways is being pushed, so that any airplanes arriving can land and take off.

Anent a Texas Femme

"IT'S a good landing if you can walk away from it."

This axiom has guided Laura M. Rissmann, flying secretary to V. I. Moore, dean of student life, University of Texas, Austin, through the first steps of her budding career as an aviatrix.

The first woman pilot to obtain a license in Denton County and the second licensed woman pilot in Travis County, this feminine flyer belittles her distinctions with a tilt of her pretty head and says that aviation attracted her because it seemed to hold such a glorious future.

It's hard to imagine a prim and dignified secretary donning dirty overalls and a pilot's helmet before and after working hours, but that's exactly the way Laura Rissmann obtained her private license. Miss Rissmann used a Curtiss-Robin with an OX-5 motor in her flying lessons.

"There were all sorts of possibilities for landings in the field at Denton," she says with twinkling eyes. "The safest way was to coast down a cow's backbone. You see, a county road ran straight through the airport; a creek ran around one end; a small forest skirted the opposite end and scores of grazing cattle dotted the field at all hours of the day. Quite a place to learn flying technique!"

Miss Rissmann welcomed the spacious landing fields on her arrival in Austin to become Dean Moore's secretary. Almost every afternoon finds her at the airport adding hours to her already enviable record.

Mrs. Pressler Wins Acclaim

ALL the boys around the hangar call her "Dot," but perhaps it would be more dignified to refer to her as Mrs. Dorothy Pressler, Oklahoma's most noted aviatrix. Doing a man's job in aviation is no snap, but it can be done according to her decision.

Four years ago, she soloed an ol' American Eagle in eleven hours and that was "sumpin" in those days. Behind her prop wash, since that time, are experiences that many men pilots envy. Very nonchalantly she does the entire bag of aerial acrobatics, after which she steps out of the plane very girlish like, lifts her goggles and powders her nose before someone takes her picture.

Mrs. Dorothy Pressler who has made a name in Southern aviation circles.

Mrs. Pressler was taught how to move the ailerons by Bennett Griffin, trans-Atlantic speed holder, at the old Graham school of flying and since then has been connected with Curtiss-Wright. At the present time she is marking up the books for Clint "Pop" Johnson's Oklahoma Aviation Service, Oklahoma City.

Her latest achievements have been the acquiring of a transport pilot's license and being made the new national finance officer of the Betsy Ross Air Corps. She is the only woman in Oklahoma to hold a transport license at the present time. This title is very remarkable but is in direct keeping with an epochal flight made with Captain Bill Bleakly, as passenger, in which she set an altitude record for a three-cylinder pusher type plane, reaching 16,090 feet. This feat brought national comment and approval to Mrs. Pressler. Air racing is her favorite sport, and she would sooner hear the drone of an airplane motor than the chatter of female lingo about a bridge table.

"What I like about flying," Dorothy tells the boys, "is that once the throttle is pushed forward you're entirely dependent upon yourself. I know of nothing more interesting."

After her name are a string of titles that call for applause. She has recently been made head woman of Oklahoma City chapter of the Women's National Aeronautical Association, a member of the National Aeronautical Association of the U. S. A., Oklahoma City Chamber of Commerce Aviation Committee, has her name upon the rolls of the "99" Club, and a few more titles that only the elite can achieve.

The Flying School Master

Les Lewis all set and ready for a new student.

AT THE All American Airways, in Miami, is Les Lewis, known to many as "the Flying School Master." Les is at the head of the flying school conducted by the All American Airways at Wentworth Field and has taught many people to fly. He is a pilot with some 3500 hours to his credit, with never a crack-up nor accident of any consequence.

Les learned to fly in 1919 while living at Nashville. He has been an instructor since 1923.

During the past seven years, Les has trained some 250 students and taught them to fly. Only one of his students failed to pass an examination and secure a pilot's license. Of these 250 students, some 20 were women. The majority have been business men who are taking up aviation as a hobby or as an aid to their business. They expect to use a plane to get them from point to point around the country just as they adopted the automobile for the same reason some years ago.

In age, these students have ranged from 16 years to 68. The sixty-eight year old pupil was a man, retired from active business, who enjoyed flying and got a big kick

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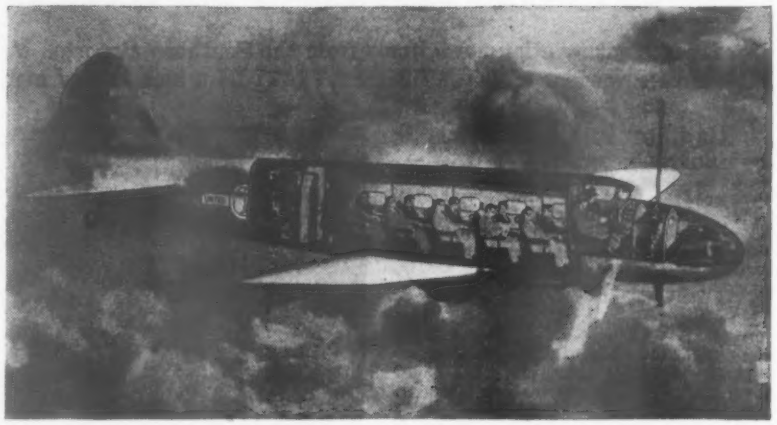
Seating Arrangement of the Boeing Transport



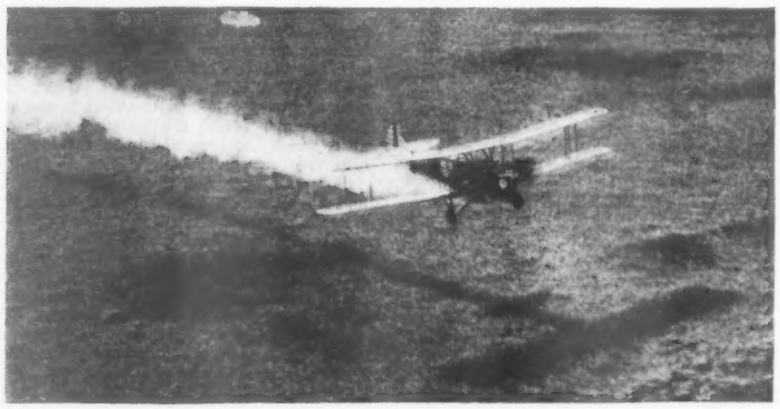
Interior arrangements of the new Boeing Transport that may be of assistance to model builders.

THE accompanying sectional view of the new Boeing low-wing bi-motored transport plane shows very clearly the disposition of the passengers and baggage. Every cubic inch of the fuselage is usefully employed.

Starting at the nose is the first mail and baggage compartment, and directly to the rear of this space is the compartment for the two-way radio equipment. Next comes the pilots' compartment with a partition between the pilots and the ten passengers. The passengers' compartment is 20 feet long and has ample space for comfortable seating.

At the rear of the passenger cabin is a lavatory and the equipment for the stewardess. Last is the rear mail-baggage space which affords a considerable amount of storage space for the accommodation of passenger baggage and mail.

How the Mosquitoes Were Licked in Panama



Here goes the mosquito chaser, spraying the ground with a heavy fog of oil. A high pressure is required to produce a fog like this.

THE French declared many years ago, that the mosquitoes were in Panama to stay. The Panama Canal venture was an expensive failure!

Uncle Sam stepped in, eliminated the winged pests and built the canal. But the warfare which began then has waged unceasingly ever since. The Canal Zone itself has been practically cleaned up, but mosquitoes bred in the swamps of the Republic of Panama, are constantly invading the forbidden territory. Consequently, Army Air Corps men in the Canal Zone have been charged with the task of getting rid of the malaria-carrying insects.

At France Field, experiments were made during recent months, in which preparations consisting of Paris Green and dust have been sprayed by plane over breeding areas. Although the Anopheles type (malaria carrying) of mosquito has been killed with the poisonous concoction, this work was only partially successful.

Other insects, nuisances even though non-poisonous, seemed to be immune

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How the Tail Group is Built

by

VERNON W. PAYNE

FIRST, before entering upon the problem of lightplane tail design, we take the speed, size and power of the plane into consideration. It will be considered a low powered ship if it has a wing area of about 150 square feet with approximately a 30 h.p. engine.

A medium speed ship will be classed as one having about 90 square feet of wing area with 40 h.p., while a fast lightplane would be one of about 50 square feet of wing surface powered with a 50 h.p. engine. It should be understood that all of the lightplanes are of the single-place type. These factors determine the size and type of tail that must be used.

Now, the proper proportion of the tail is an all important matter in the controllability and the stability of a plane, hence this matter is a far more vital detail than ordinarily considered by the beginner, who in the past has been content to sketch around on his layout until the tail size looked right to him. Such procedure is unsafe and the proper areas should be determined with accuracy if the best results are to be obtained with the plane.

It is assumed that the slow low-powered ship would have an externally wire braced thin tail surface because this ship must be light in weight. The tail for the medium fast ship can be either of the cantilever or externally braced type, while the tail for the fast ship must be a cantilever to avoid the excessive resistance of bracing at high speed.

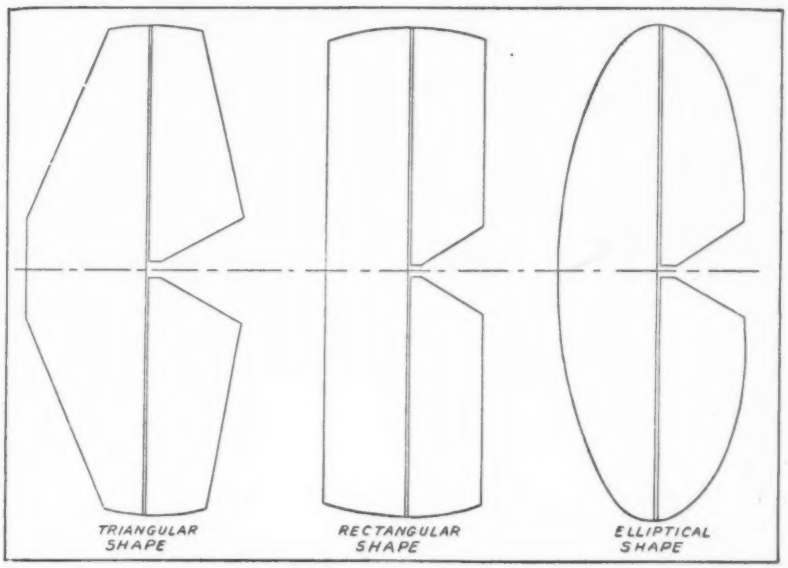


Fig. 1. Representative horizontal tail surfaces. Of the three shown, the elliptical (right) is the best all around form.

The area of the tail group depends upon several factors. In general the surfaces produce a force acting at the end of a lever arm, formed by the fuselage. The air pressure on the tail surface is then applied to the end of the fuselage, which turns the wings in the required direction.

Therefore, the effectiveness of the tail group in steadying or turning the wing group about, depends upon the area of the surface, upon the velocity of the air which creates the pressure on the tail surface and the length of the fuselage, or the effective lever length. All other things being equal, a larger tail surface will be required with a short fuselage than with a long member. Again, if the ship is slow, then a larger tail, a longer fuselage, or both, will be required to develop the necessary turning moment. At high speed, the air pressure is greater on

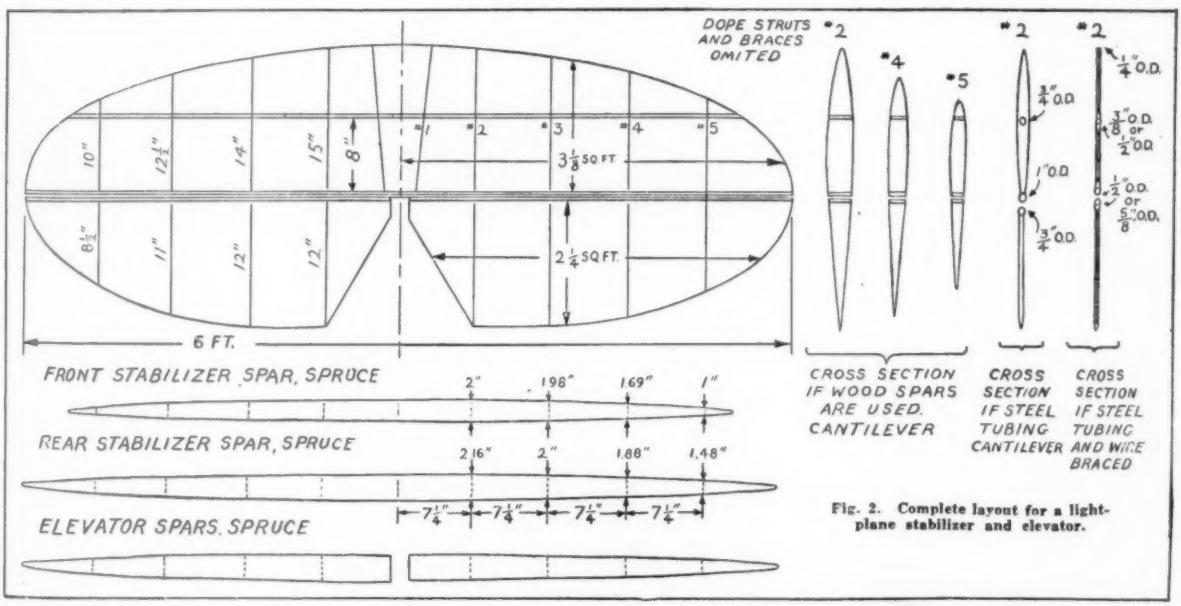


Fig. 2. Complete layout for a lightplane stabilizer and elevator.

the tail, hence it will have a greater turning moment than at low speeds.

An excessively large tail group, on the other hand, produces excessive resistance, takes too much power, and at the same time it requires too much manual effort to handle the controls. At high speed, the control surfaces become unduly sensitive if the area is greater than necessary and this makes it difficult to handle the ship. Again, the area of the tail-group must be taken in connection with the side area of the fuselage, the areas of the landing gear and of the pontoons or hull, if the craft is a seaplane or flying boat.

A round section monocoque fuselage requires more tail area than a flat sided type for the reason that the round body presents less effective side area than the straight flat sides. In the case of a seaplane or flying-boat, still more tail area will be required to counteract the side areas of the pontoons or hull that project out well in front of the center of gravity. It is also obvious that a very deep flat sided fuselage requires less vertical fin area than a shallow body since the deep sides are very effective fin areas within themselves.

The average planes of today have a lever arm length of 3 times the width of the wing chord, measured from the tail post to the center of gravity (C. G.). This distance is reduced to 2.5 times the chord in some acrobatic ships, and this in turn calls for a greater tail area to compensate for the short fuselage length. However, for the average lightplane, it will be best to maintain the more usual ratio of 3 times the chord.

Assuming the fuselage length for our lightplane, as above, the following tail group areas will be proper, the tail areas being taken as fractions of the main wing area (A).

TAIL SURFACE AREAS

TOTAL HORIZONTAL, Stabilizer plus elevators A x 1/6.

TOTAL VERTICAL SURFACES, Fin plus rudder A x 3/40.

TOTAL VERTICAL SURFACES for round monocoque A x 1/12.

Of the total horizontal surfaces given above, the elevators are usually made 45 per cent (0.45) of the total area while the stabilizer is 55 per cent. The movable surfaces, the elevators and rudder are made so that they will move 25 degrees either side of the body centerline. The aspect ratio of the horizontal surface is usually 3.0 while the aspect ratio of the vertical surfaces is about 2.0 in the average case.

Just as an example of working out these rules we will assume a one-place fast monoplane having a wing area of 60 square feet with a chord width of 36 inches. As the elliptical tail surface, Figs. 1-2, combines the strength of the triangular tail and the more efficient rectangular tail, we will employ the elliptical type. The usual aspect ratios will also be employed.

Total area of horizontal surface = 60 x 1/6 = 10 sq. ft.

Total area of vertical surface = 60 x 3/40 = 4.5 sq. ft.

If a monocoque body is used, then the area of the vertical surface will be: 60 x 1/12 = 5.0 sq. ft., or 0.5 sq. ft. larger than with a square section fuselage. Fig. 2 shows the dimensions and shape of the tail surfaces. Since the aspect ratio is 3.0 and the average chord of the horizontal tail is 2 feet, then the span of the horizontal tail will be: 3.0 x 2 = 6 feet. If we use a smooth monocoque body, the shape and size of a suitable tail is that shown by Fig. 2. The stabilizer will have two spars and the rear spar of the stabilizer will carry the total air load on the elevators plus part of the stabilizer load. The front spar takes care of the load on the front edge of the stabilizer.

Further consideration must be given to the constructional features. Shall we make the members of steel or wood? Shall our surfaces be of the cantilever or wire braced type?

If a wire braced tail is required, then

(*Concluded on page* 130)

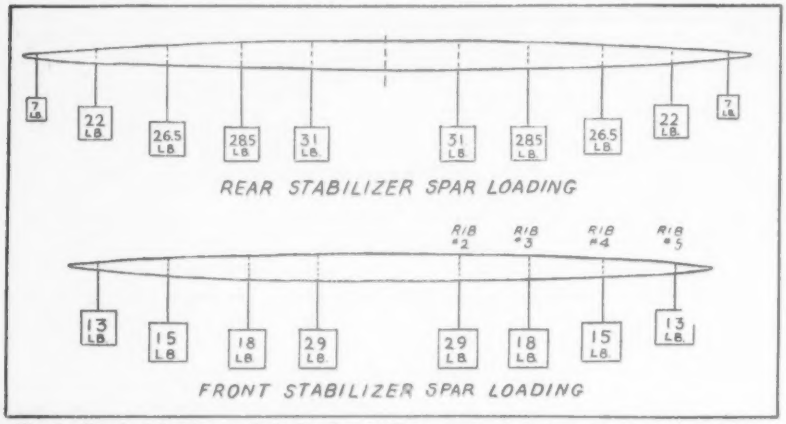


Fig. 3. Standard loading methods for the stabilizer spars. Sand bags are used for weights.

Ed Nelson—Early Bird

by J. B. R.

Ed Nelson, our genial pilot and Early Bird.

LADIES and Gentlemen! We have with us this evening, Mr. Ed Nelson, pioneer aviator, constructor, instructor, exhibition flyer, Early Bird and founder of several aeronautical institutions.

Just at present he is in charge of the exhibit of planes at the Chicago Air Show, Century of Progress, Chicago, where he supervised the erection of the planes in that really wonderful exhibition.

"When did you first start in this aeronautical monkey business?" I asked Ed when I met him at the show and renewed acquaintanceship after a lapse of years.

Ed stopped in the act of sorting out a bunch of miscellaneous tail-groups, wings and wires, and spoke as follows, at least approximately as follows, leaving out non-essentials, etc.

"Well, I got the bug back in 1911 but it wasn't until 1914 that I soloed in a Model "B" Wright. Then near the end of 1914 I got hold of an old Curtiss tripod pusher and gave exhibitions on this ship all over the country until the U. S. A. entered the war."

"Then, I suppose you entered the service," I said as this original thought struck me. "Were you an ace—or something during the World conflict?"

"Yes, I went into the service but the M. D.'s practically spoiled the war for me. If there had been a little more construction and less destruction it would have suited me Jake." Deep in cogitation, Ed then attempted absentmindedly to fit a Bleriot tail on a Thomas-Morse Scout, and resumed the thread of his discourse.

'After I got out of service I became shop instructor at the Bud Morris Airplane School, teaching a lot of swipes how to weld tubes, saw boards, glue up ribs and all the rest of it. You re-

(*Concluded on page* 131)

How to Build the Corben Junior Ace

by O. G. CORBEN

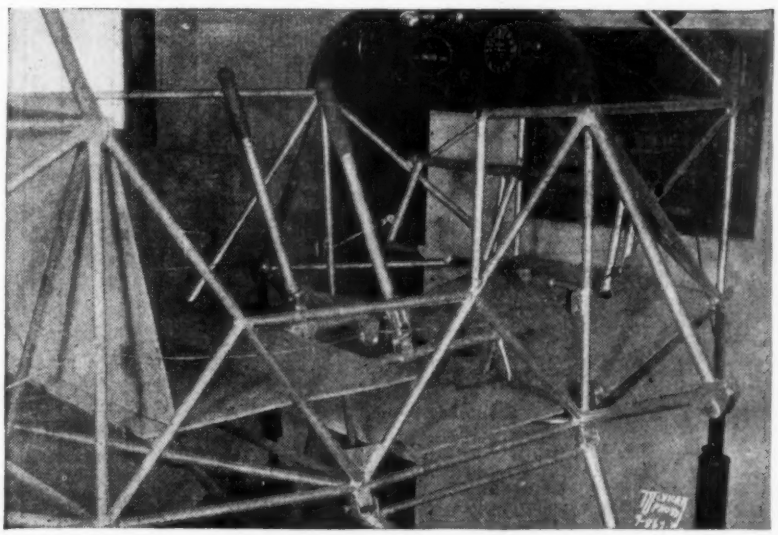
PART V

In this article we will install the controls and construct the landing gear with its shock-absorbers. There is not a great deal left to do.

PRESUMING that you have your Corben Junior Ace fuselage welded up, I will give you the dope for installing the controls and building up the landing gear this month, starting with a few general remarks on these two vital parts of the ship.

For the benefit of those who are not familiar with the lightplane, I wish to say that it stands to reason such a plane would ordinarily be lighter on its controls than a heavier ship. Therefore, in designing the Junior Ace, this point was taken into consideration and the controls were so geared that approximately the same movement is required on the stick and rudder as in a larger ship, thus reducing over-controlling to a minimum. You will find your Junior Ace will have the same feel on the controls as a larger ship if you follow all of the details of the controls.

Now, just a few words about the landing gear before we go into the assembling details. You will note from the photo, at a glance, that there are no hub caps showing on the outside of the wheels and it may seem a little strange at first but the hub caps are located inside of the wheels away from grit and dirt. This reduces wear considerably. The wheels are made of cast aluminum in two halves which are held together with three nickel-steel bolts. This type of wheel has another outstanding feature which should not be overlooked, for strange as it may seem, airplane tires do go flat and often this happens in the air.



The controls and the instrument board installed. As will be seen, dual controls are installed in this ship.

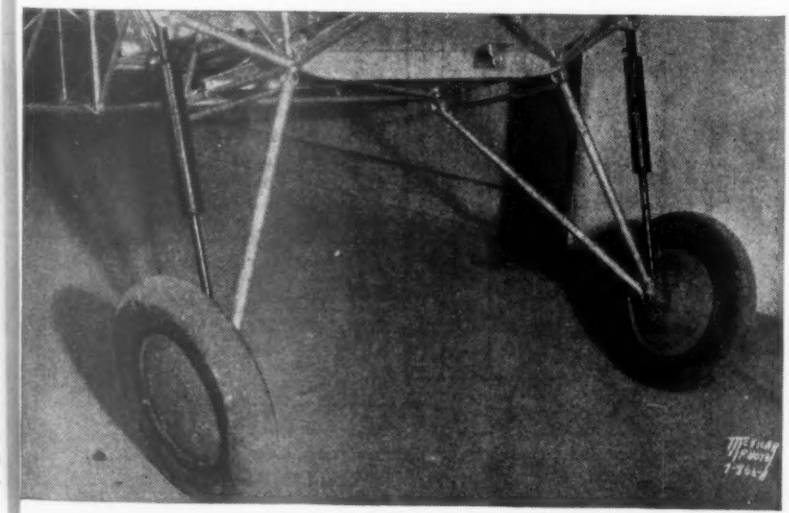
If you are familiar with "drop-center" tires on cars, you know that they have a very bad habit of rolling off when they go flat and you can imagine your embarrassment if you were to land after a pleasant flight and see one of your tires go rolling off down the field ahead of you. I say imagine, for when you use a wheel as shown on the Junior Ace, you will not have such a thing happen for the wheel does not have drop-center, instead, the wheel is taken apart, the tire is then put on and the wheel is bolted together. This also eliminates the usual struggle which takes place when putting a small tire on a regular wheel.

Regardless of how good a pilot may be, once in a while he may make a landing—either due to a rough field or just plain carelessness—which is rather hard on the ship, so we have tried to design a shock-strut that is simple and at the same time effective enough to take up a great amount of the shock before it is carried into the structure of the ship. You will find that the strut shown works out to perfection. You will notice that the shock strut consists of two pieces of tubing, a few washers and two springs. There is no oil to leak out and the strut requires no attention with the exception of a little grease. Contrary to the average belief there is practically no rebound from the springs.

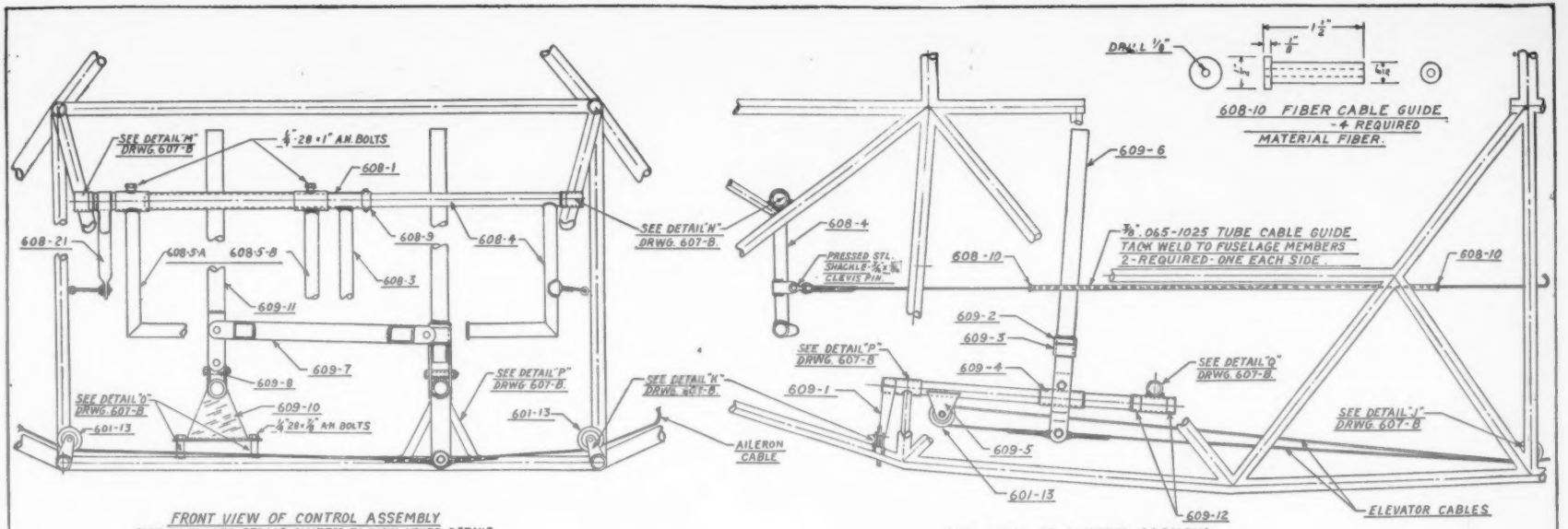
We will start off by building the controls into the fuselage. Drawing 608 shows sections of the fuselage with the controls detailed in place and by tracing the parts numbers you will find each part clearly shown in full detail.

The rudder pedals are made up in two parts which are held in place when assembled in the fuselage by collar 608-9. It is best to make up the two pedals No. 608-5 (A) and (B) first, sliding these on the tube 608-1 before pedal 608-3 is welded in place. Note there are two pieces of ⅝ inch .095

(*Continued on page* 115)

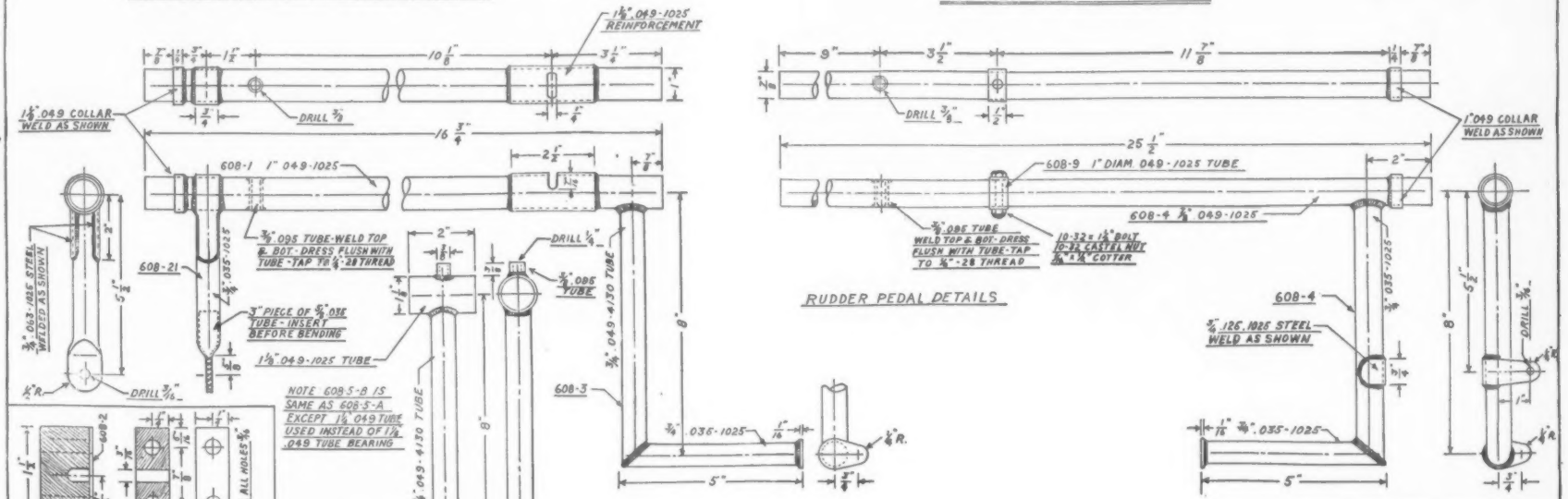


The landing gear is equipped with shock-absorbers—the two cylinders near the body.



FRONT VIEW OF CONTROL ASSEMBLY
PART OF RUDDER PEDALS OMITTED TO SHOW OTHER DETAILS

SIDE VIEW OF CONTROL ASSMBLY-

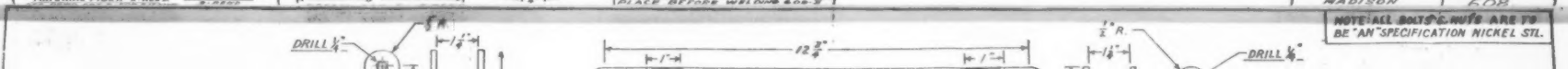


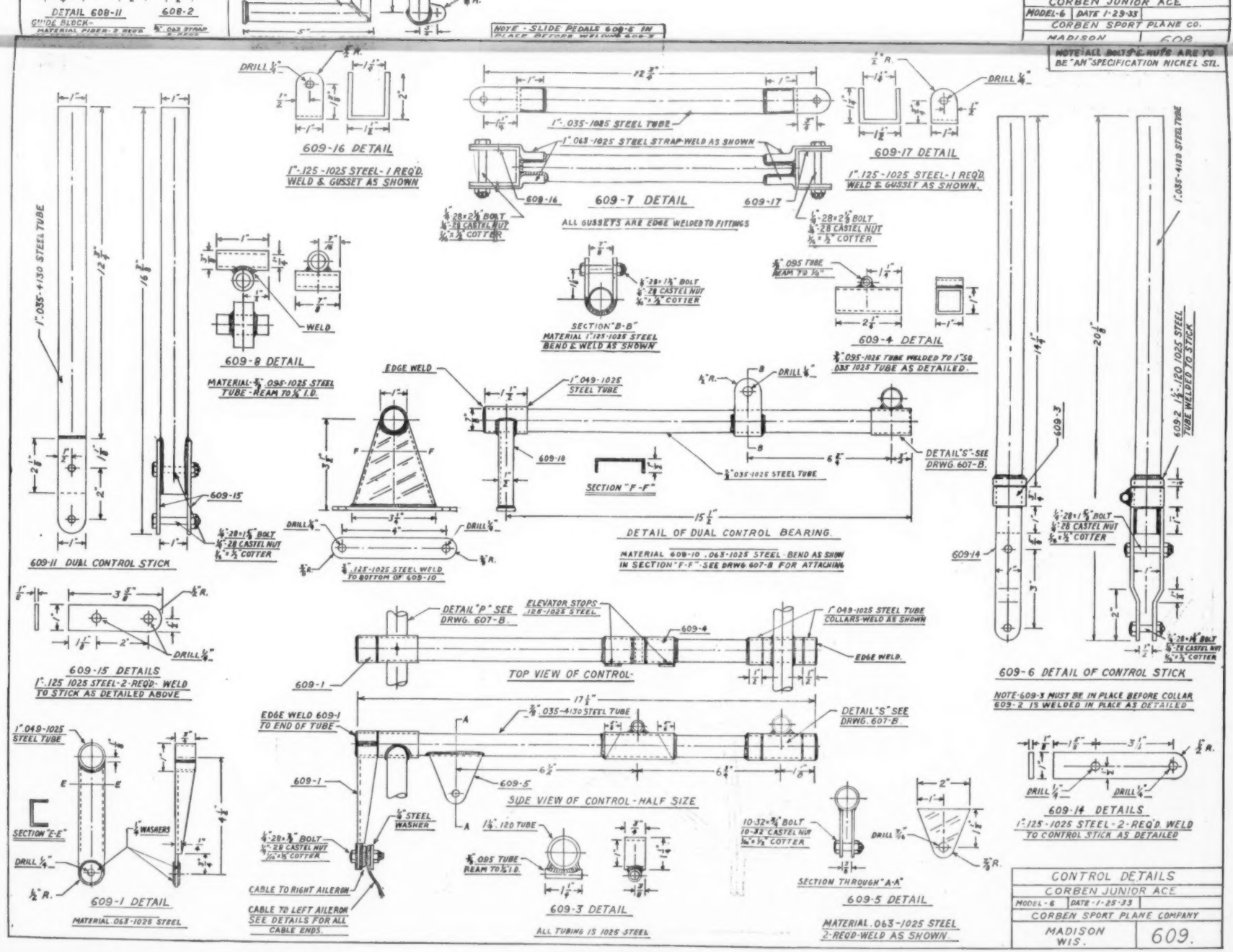
RUDDER PEDAL DETAILS

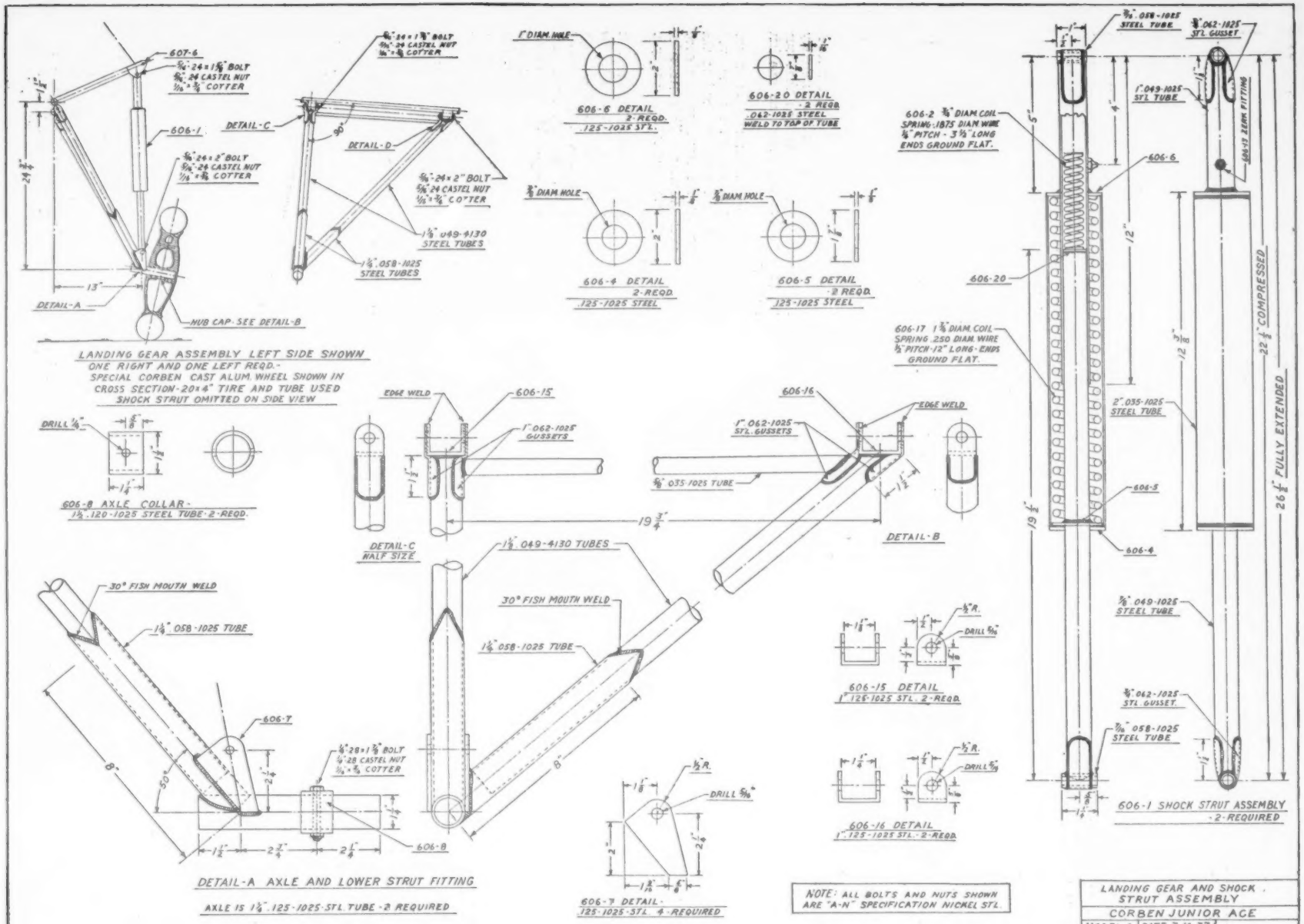
NOTE: SLIDE PEDALS 608-6 IN PLACE BEFORE WELDING 608-3

CONTROL DETAILS	
CORBEN JUNIOR ACE	
MODEL-6	DATE 1-29-33
CORBEN SPORT PLANE CO.	
MADISON	608

NOTE: ALL BOLTS & NUTS ARE TO BE "AN" SPECIFICATION NICKEL STL.




DETAIL 608-11
608-2
GUIDE BLOCK-
MATERIAL FIBER-2 REQ'D.
NOTE - SLIDE PEDALS 608-6 IN PLACE BEFORE WELDING 608-2
CORBEN JUNIOR ACE
MODEL-6 DATE 1-29-33
CORBEN SPORT PLANE CO.
MADISON
608
NOTE: ALL BOLTS & NUTS ARE TO BE "AN" SPECIFICATION NICKEL STL.
609-16 DETAIL
1"-.125-1025 STEEL-1 REQ'D.
WELD & GUSSET AS SHOWN
609-7 DETAIL
1".035-1025 STEEL TUBE
1".063-1025 STEEL STRAP-WELD AS SHOWN
609-16
609-17
ALL GUSSETS ARE EDGE WELDED TO FITTINGS
609-17 DETAIL
1".125-1025 STEEL-1 REQ'D.
WELD & GUSSET AS SHOWN.
1".035-4130 STEEL TUBE
609-8 DETAIL
MATERIAL-⅝".095-1025 STEEL TUBE-REAM TO ⅝" I.D.
WELD
SECTION "B-B"
MATERIAL 1".125-1025 STEEL
BEND & WELD AS SHOWN
609-4 DETAIL
⅝".095-1025 TUBE WELDED TO 1".50 .035 1025 TUBE AS DETAILED.
609-11 DUAL CONTROL STICK
609-15
609-10
EDGE WELD
SECTION "F-F"
DETAIL OF DUAL CONTROL BEARING
MATERIAL 609-10 .063-1025 STEEL-BEND AS SHOW IN SECTION "F-F" SEE DRWG 607-B FOR ATTACHING
DETAIL "S" SEE DRWG. 607-B.
609-3
609-14
609-2 ½".120 1025 STEEL TUBE WELDED TO STICK
609-6 DETAIL OF CONTROL STICK
NOTE-609-3 MUST BE IN PLACE BEFORE COLLAR 609-2 IS WELDED IN PLACE AS DETAILED
609-15 DETAILS
1".125 1025 STEEL-2-REQD. WELD TO STICK AS DETAILED ABOVE
DETAIL "P" SEE DRWG. 607-B.
ELEVATOR STOPS .125-1025 STEEL
1".049-1025 STEEL TUBE COLLARS-WELD AS SHOWN
609-4
609-1
EDGE WELD.
TOP VIEW OF CONTROL-
609-1 DETAIL
MATERIAL .063-1025 STEEL
EDGE WELD 609-1 TO END OF TUBE
⅜".035-4130 STEEL TUBE
609-5
SIDE VIEW OF CONTROL-HALF SIZE
609-14 DETAILS
1".125-1025 STEEL-2-REQ'D WELD TO CONTROL STICK AS DETAILED
CABLE TO RIGHT AILERON
CABLE TO LEFT AILERON
SEE DETAILS FOR ALL CABLE ENDS.
609-3 DETAIL
ALL TUBING IS 1025 STEEL
SECTION THROUGH "A-A"
609-5 DETAIL
MATERIAL .063-1025 STEEL 2-REQD-WELD AS SHOWN
CONTROL DETAILS
CORBEN JUNIOR ACE
MODEL-6 DATE-1-25-33
CORBEN SPORT PLANE COMPANY
MADISON WIS.
609.



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tube welded into the rudder tubes 608-1 and 608-4, drill a ⅜ inch hole through the two torque tubes as detailed, then insert the small ⅜ inch tubes, cut them long enough so about ¼ inch sticks out on each side of the torque tubes, next weld them both top and bottom in such a manner that the weld goes through the tube and holds from the inside.

After the weld is cool, cut the small tubes off and file the ends down so they are flush all around the torque tube, now tap them out to ¼ inch x 28 as you will note from the front view of the rudder assembly, the dual pedals are held in place by two ¼ inch bolts screwed into the small tubes. I do not believe it is necessary to take up a lot of space by explaining every little detail as they are all clearly shown and should not cause you any trouble whatsoever. I do wish to mention that care should be taken in lining up the parts before welding so that they will all be square and true.

On Drawing 609, you will find the control stick and the dual-stick details and by referring to Drawing 608, you will see from the side view of the fuselage section how the control stick is assembled. In making up the main control stick it is necessary that the collar for attaching the dual cross-arm No. 609-7 should be a snug fit but should rotate around the stick freely. This collar is part No. 609-3. Do not weld around the top of 609-14 as they should be square and act as a bottom bearing for 609-3.

As you will note from cross section F-F the front support for the dual torque tube support is made up of sheet steel formed as shown with a piece of ¾ inch .125 steel welded across the bottom.

The dual control stick is quickly taken out by simply unscrewing the two ¼ inch bolts and pulling the control out of the rear support bearing which is welded to the seat brace.

It may be well to mention that nickel-steel bolts are to be used throughout the entire control system. Do not under any circumstances use any other kind of bolts. Be sure that you build up your controls so that all the holes line up, for if you do not, the controls will bind and no doubt get you into a lot of trouble.

When you do not care to use the dual rudder pedals, they may be disconnected by taking out the two bolts which hold them in place. A clip may be made up under the dash so that the pedals can be fastened up out of the way by snapping them into the clips, or they may be disconnected and left to hang free.

It is not necessary to build up the dual controls unless you desire them.

(*Concluded on page* 132)

Elementary Stress Analysis

by LES LONG

BEFORE going any farther with this article, I want to advise all you gentlemen who are familiar with real mathematics to turn to page 3000 and continue to your right. This ain't for you. It is for a large number of earnest young men who have never had the kind of schooling that would make them handy with Naperian hyperbolic logarithms and differential calculus.

I do not propose to make anyone a stress engineer in three simple lessons. What I intend is to give a sort of insight into the basic idea of our old enemy, "Stress Analysis." It will seem very primitive to some of you, but it is exactly what has been needed for a long time, and it is hoped that it will lead to a desire for delving further into a very deep subject.

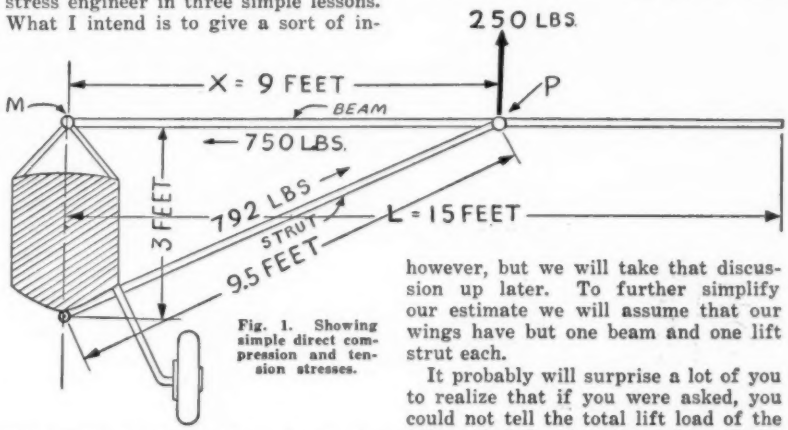


Fig. 1. Showing simple direct compression and tension stresses.

It is a remarkable circumstance that hundreds of light airplanes have been built and flown by men who had very little conception of the actual stresses that their handiwork would be subjected to. It is a credit to them that so few accidents have taken place, and it goes to show that good mechanical sense and actual static tests may safely take the place of the fateful stress analysis. Some knowledge of the stresses developed means a great saving in time and material.

As we must all admit that a truly efficient light plane should be a monoplane, we shall start out with a parasol type ship having a span of 30 feet and a chord of 50 inches. This represents about the ideal size for a lightplane.

In order to simplify matters, for the time being, we shall assume that the wings of this ship are of constant chord and thickness, that the tips are not rounded and that there are no tip losses. Such is not the actual case, however, but we will take that discussion up later. To further simplify our estimate we will assume that our wings have but one beam and one lift strut each.

It probably will surprise a lot of you to realize that if you were asked, you could not tell the total lift load of the wing taken by the strut when placed at any given location. This strut location is far more important than you might suppose.

It should be plain enough that, if it were in the center, it would take the entire lift of the wing and if it were placed at the extreme end it would take just half the lift, the other half of the load being taken by the cabane over the fuselage. It so happens that neither of these locations are best for the purpose, so we must know how to calculate the lift taken by the strut when it is attached elsewhere. In practice this location is generally around 60 percent of the distance out along the wing.

The formula for calculating the percentage of the lift taken by the strut

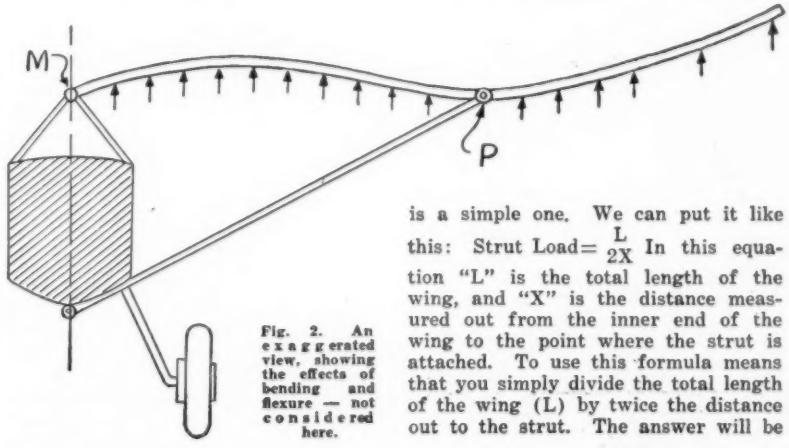


Fig. 2. An exaggerated view, showing the effects of bending and flexure — not considered here.

is a simple one. We can put it like this: Strut Load $= \frac{L}{2X}$ In this equation "L" is the total length of the wing, and "X" is the distance measured out from the inner end of the wing to the point where the strut is attached. To use this formula means that you simply divide the total length of the wing (L) by twice the distance out to the strut. The answer will be

the percentage of lift carried by the strut.

For an example, let's say the wing is 15 feet long and the strut location 10 feet out. Therefore, we divide 15 by 2 times 10, and the answer is 0.75 percent of the total lift. Simple, isn't it?

Now that we know how to calculate the percentage of the lift taken by the strut, we must find out how to calculate the actual stress developed in the strut by this lift. Due to the fact that the strut is at an angle to the plane of lift, the stress in it will always be higher than if it were at right angles to the beam.

It should also be plain that, because this stress is not at right angles to the beam, the beam will also have an additional stress developed in itself. The sharper the angle between strut and beam, the greater will be the stresses developed in both. That is why the lower end of the strut should be kept down and as far away from the wing root as possible.

The simplest possible way to calculate the stresses developed in such a wing truss is by graphic means. We draw an accurate layout of the ship using a scale of, say, one inch to the foot. Using the 15 foot wing, we place the strut out 9 feet. We make the lower end of the strut 3 feet below the wing root and there is no dihedral.

Our wing truss now looks as in the sketch (1). The truss is a triangle which includes a beam length of 9 feet, a vertical height of 3 feet (which is directly at right angles to the beam) and a strut length of 9.5 feet.

We will now give our ship an estimated weight of 700 pounds, fully loaded. The wings weigh 50 pounds each, and as the wings are not figured in flying load calculations, we deduct 100 pounds, leaving a flying weight of 600 pounds, or 300 pounds per wing. To find what part of this 300 pounds is carried by the strut we go back to our little equation of $\frac{L}{2X}$ and find that (L) is 15 feet and that (X) is 9 feet. Therefore, we divide 15 by (2 times 9) and get approximately 0.83 or 83 percent of the lift. As the lift is 300 pounds, 83 percent equals 249 pounds, let's say 250 pounds in round numbers which is the share of the lift taken by the strut.

Going back to our scale drawing, we must grasp one fundamental idea. The vertical, or 3-foot side of the triangle, represents the lift taken by the strut. Get this right. In this case the lift is 250 pounds so that the 3-foot side of the triangle represents 250 pounds.

Now, the stresses in the other two sides of the triangle are also directly in proportion to their lengths relative to this 3-foot side. Note that carefully. Since the beam length is 9 feet, it is exactly 3 times the length of the vertical side, hence the stress in it is 3 times 250 or 750 pounds. Since the strut length is approximately 3.17

(*Concluded on page* 139)

Glenn Curtiss Opens First School on Coast

Members of the first Curtiss flying school to be established on the Pacific Coast.

BACK in the dim vistas of 1910-1911, Glenn Curtiss opened the first Pacific Coast flying school at Rockwell Field, Calif., and here we see the "stujents" of the first class.

This is not the first model of the Curtiss pusher, for that ship had a front elevator, but it is an intermediate type built before it was considered safe to eliminate the front booms altogether. Later models of the pusher had nothing projecting forward of the wings but the chassis. Glenn Curtiss is shown standing, second from the left.

Moisture in Airplane Wood

THE time required to determine accurately the amount of moisture in airplane wood has been reduced from a week to a few seconds. Apparatus developed by Dr. C. G. Suits, the General Electric Research Laboratory and M. E. Dunlap, United States Forests Products Laboratory, Madison, Wis., makes it possible for a workman to check any or all boards in a consignment speedily and without spoiling the lumber by cutting out samples.

A tap with a special hammer, a turn of a dial, a flashing red light or a buzz and the analysis is made. It is easy for the inspector to move around the lumber pile or plant or to check different sections of the same board as may be required.

It has long been known that the electric resistance of wood depends on moisture content, but satisfactory equipment for utilizing this knowledge was not previously available. With the new apparatus carrying two neon glow lamps, the moisture content of wood is now determined by a modification of the conductivity method.

One of the neon lamps is connected across a fixed condenser and so adjusted that when the condenser builds up current to a certain point, the neon tube discharges with its characteristic red flash. This rate is adjusted to about one flash per second. The other neon tube and its condenser are in series with knife-edged electrodes on a hammer which are driven into the wood. The rate at which this condenser builds

The moisture testing instrument complete.

up its charge depends on the conductivity and, therefore, upon the moisture content of the wood.

By means of a variable condenser this circuit is adjusted so that the two tubes flash simultaneously. The dial of the variable condenser then shows the percentage of the moisture in the wood. The adjustment can also be made by listening to a buzz in earphones.

Investigations show that the resistance relation to the moisture content of domestic lumbers is independent of kind of wood, but with some very heavy imported woods the rule does not apply. Similarly, investigations show that differences due to the depth of penetration of the hammer electrodes or to the direction of the grain of the wood are negligible.

The moisture content indicator is a

(*Concluded on page* 129)

What Our Readers Are Building

A department devoted to our readers' activities in airplane, glider and engine construction, showing the latest developments.

Thanks—Fellows

WE'VE had a great response to our last call for more photos and we wish to thank you for them. For a time, we were getting kinda fidgety when we saw our stock running low, but we are sitting pretty once more.

POPULAR AVIATION readers certainly come to the rescue in a manner wonderful to see. We no sooner ask for the dope than there it is—pronto.

And here we wish to call your attention to an error in the July issue. The photograph of the engine on page 44 is the Long "Harlequin" engine, and not the Pickell engine as announced. Wish Les Long would sign his photos—it's his one and only failing.

Where to Find Suggestions

OUR Readers' Department and the Dream Ship Department are more or less related to each other. If you are suffering from a lack of new ideas to incorporate into that new lightplane just give the dream ships the double-O.

Of course, some of the dream ships are out of the question and have been printed because of certain humorous qualities they may possess, but there are also some very meritorious and practical ideas shown which should be of assistance to the home designer.

Every once in a while, a dreamer hits on a real idea that should be carefully noted. You may not approve of the proportions, the color scheme or many of the details, but just the same, some of the dream ships are not bad at all.

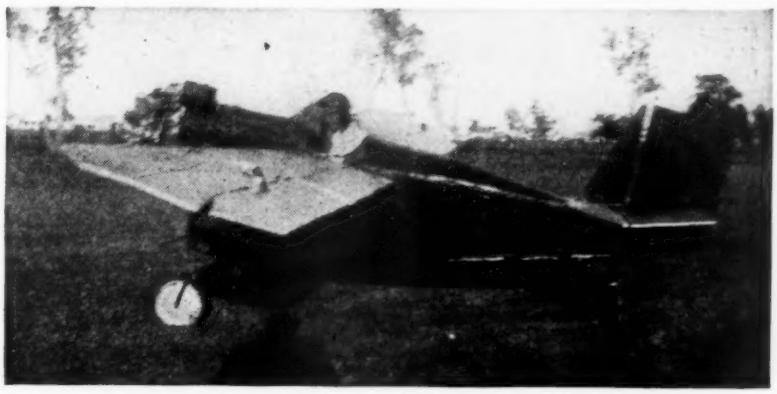
What About Single Surfaces?

AT THE present time, a great deal of attention is being paid to the relative values of airfoils or wing sections all of which are double surfaced with fabric on the top and bottom faces. While undoubtedly, such double surfaced airfoils are the most efficient, yet quite good results were obtained with the old single-surface wings that were cast into the discard long years ago.

Many of the old pusher types, using single surfaced wings, were kicked along at a good speed by a 30-40 h. p. engine and were very maneuverable. They would probably not show up very well in a wind-tunnel test, but in practical service they did much better than would be considered possible in the light of modern knowledge.

It would be interesting to note the results of further experiments along these lines for certain structural advantages are made possible by single surfacing, and undoubtedly fairly good efficiency could be obtained in this way by carefully guarding against the mistakes made by the old-timers.

A Texas Hedge-Hopper Hops



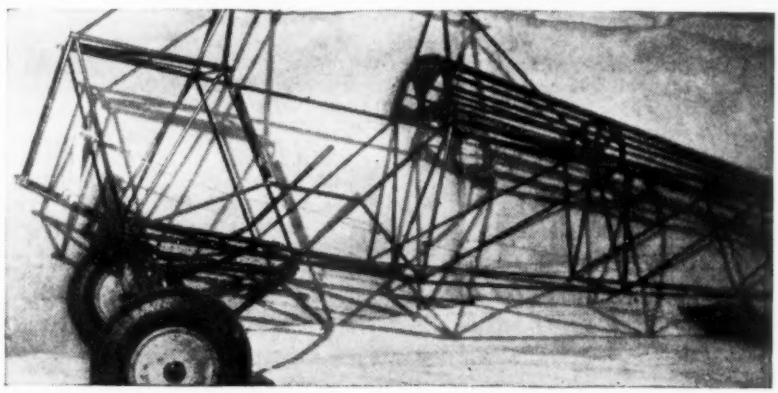
The Texas Hedgehopper all ready to hop. Lots of fun, we'll say.

THEY are grounded down in Texas so the next best thing to a lightplane is a hedge-hopper that is neither bird, animal or vegetable. The hopper shown here was constructed by P. L. Meyers, Newgulf, Texas, with the assistance of a high-school boy, Jap Cox. It took about three months to complete it and cost less than $100.

"It is a hopper in every sense of the word," says Mr. Myers, "for at 35 to 40 m.p.h., it will sure hop. We spent practically all of our spare time and have had plenty of fun to compensate for our trials and troubles."

The span is 18 feet and 0 inches, chord 36 inches, length 13 feet and 1 inch. Powered with a Harley "74," it weighs 314 pounds empty. The top speed is 55 m.p.h. and the actual cost of operation is 52 cents per hour. Sounds like an interesting little job.

The Oklahoma Yellow Hammer



Here's Barney Alston's ship, or part of it, in full view. This picture was taken on the stage of a theater.

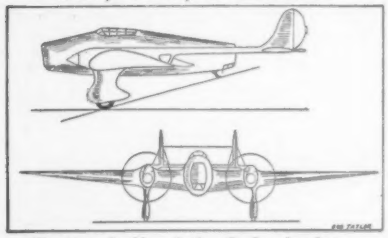
BARNEY ALSTON, Ponca City, Okla., is building the little lightplane shown here which he calls the "Yellow Hammer." He has been having his ups and downs with the legislature of his state, but is rather doubtful of the outcome. He has been working for three years on the little crate and has bought the best material that money can buy.

"If my job is a success and I cannot get it licensed," says Mr. Alston, "I will take the bull by the horns and trust to luck. They cannot do more than throw me in the "jug" and the joke will be on them as I have been in before for such things and they have to feed me."

The Yellow Hammer was built in a theater which adds to its novelty. We have had them built in barns, bedrooms, basements and churches, but this is the first theatrical job we've met.

Dream Ships by our Dreamers

Well, Well, a Bomber



Front and side of the Taylor bomber.

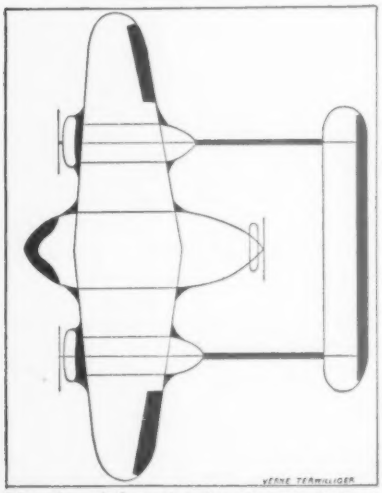
BOB TAYLOR, ???? Street, ????, Ohio, is out after big business and sends us a dream bomber. This is decidedly original and a laudable dream if it can be built for a more reasonable sum than the bombers of the past. And not a bad idea at all, for it assumes the general aspect of the Vance Flying Wing.

It is equipped with two 600 h.p. "Conqueror" engines at the head of the tail-booms and it is possible that a retractable landing gear could be used. We also make a suggestion. Namely, that the Conquerors be substituted by a hollow-shaft engine so that a couple of 37 mm. cannon could be arranged to fire through the crankshaft, giving the enemy bad dreams while the ship is in a dive.

What Terwilliger Dreamed

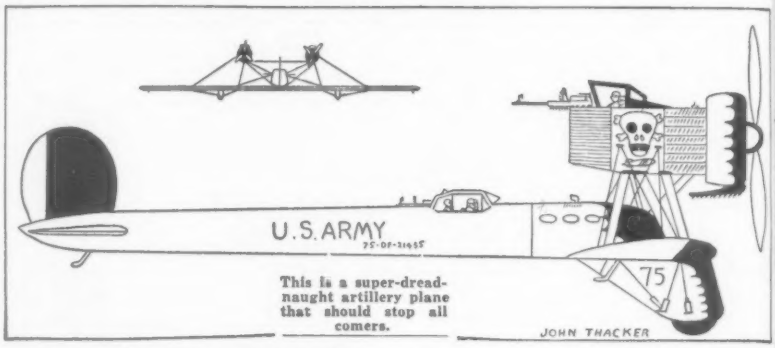
VERNE TERWILLIGER has designed a very ingenious tri-motor of the push-pull variety. The tractors are at the head of the tail booms while the pusher plant is at the rear of the nacelle.

By this arrangement, the nose of the cabin is made available for passengers with excellent visibility. The structural members are quite simple with ample support for the tail group, both good points in the design.



Plan view of the push-puller tri-motor designed by Verne Terwilliger.

Attention, U. S. Army Air Corps—Attention!

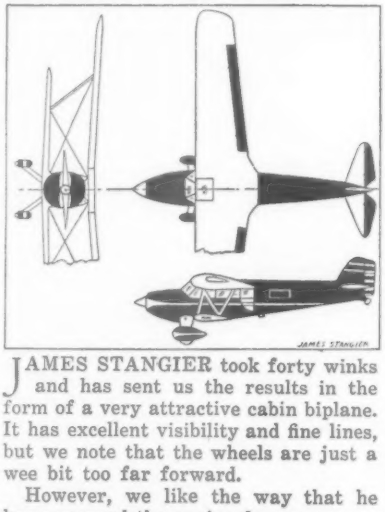


This is a super-dreadnaught artillery plane that should stop all comers.

JOHN THACKER is right back at us with a low rakish death defying military craft of an unknown type. Some imagination, this boy!

On the upper story we have the heavy artillery department which should arouse some consternation within the enemy ranks. The rear end is more deadly than the front and the mechanical section is properly labeled with a Death's head. Then, sliding down the struts to the lower story (there are no stairs), we arrive at General Headquarters, which as usual, is in a zone of peace. In the background is a guy doing an Immelmann, and well he may.

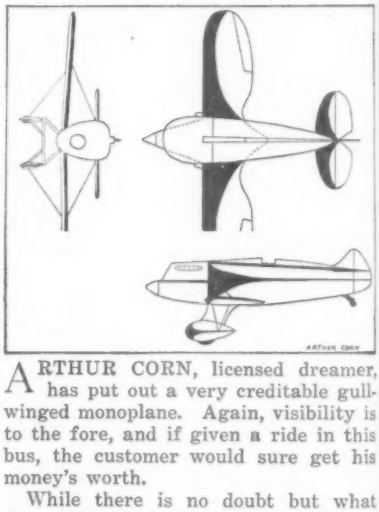
Stangier's Cabin Biplane



JAMES STANGIER took forty winks and has sent us the results in the form of a very attractive cabin biplane. It has excellent visibility and fine lines, but we note that the wheels are just a wee bit too far forward.

However, we like the way that he has arranged the engine for we can see right over the nose without any trouble at all. Some of the professional designers might well cogitate over this idea.

A Gull Wing Monoplane



ARTHUR CORN, licensed dreamer, has put out a very creditable gull-winged monoplane. Again, visibility is to the fore, and if given a ride in this bus, the customer would sure get his money's worth.

While there is no doubt but what these wings would prove very efficient, yet they certainly would be expensive to build unless the factory had a great volume of production. Very pretty ship, Arthur.

Heart-to-Heart Talk With Our Dreamers

DURING the past month we have been receiving a steady stream of dream-ship drawings of all sorts and descriptions.

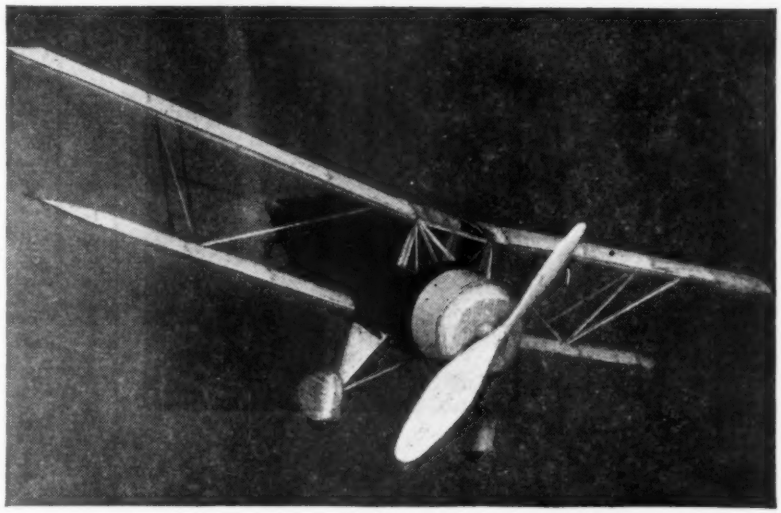
You'll probably remember that we announced that we would print the best ones, so, about the only thing left to do is to go on plugging, printing each in turn. This will take some time, but everybody — nearly everybody — will have a show. But, we have made a resolution, however, that the comical and hairbrained ideas will be eliminated. From now on we will adopt a more serious tone and print only plausible ships. There is design genius among our readers and we wish to cultivate the best that is in you.

Building the Waco "C" Biplane

by

JOSEPH S. OTT

Model Editor of POPULAR AVIATION



The accuracy of this fine flying scale model can be proved by a comparison with the front cover drawing of this issue.

NOTE the large wing area of the Waco Cabin Airplane, a model of which is illustrated in this article. The additional wing surface gained by adding a lower wing, thereby giving twice the area of a monoplane, helps considerably in the performance of this model.

To simplify the construction of the wings, where they attach to the body, it is not necessary to fair the ends of the wings as is actually the case with the big machine. This could be done, but it adds to the weight and tends to complicate the structure, making the final assembly more difficult. The landing gear struts should normally also fair into the lower longeron but here again it is advisable to cement the strut directly against the finished body and eliminate the excessive fairing. The model does not lose any of its appearance by the elimination of the streamlined fairing which is used on the big machine at the places mentioned.

The parts of the model should be constructed in the following sequence and as they are completed, should be put aside until all of the units are ready for final assembly.

The body should be completely covered before the wings are attached and the wings should be completely covered, also the rudder and stabilizer. Spray with water to draw up the tissue before these parts are cemented to the body.

No. 1. Cut all the ribs for both sets of wings.

No. 2. Assemble the top wings.

No. 3. Assemble the lower wings.

No. 4. Assemble the stabilizer in one piece.

No. 5. Assemble the rudder.

No. 6. Make two body sides.

No. 7. Assemble the two body sides.

No. 8. Add the formers to the square body.

No. 9. Add fairing strips as required.

No. 10. Assemble motor cowl and nose plate.

No. 11. Cement braces for attaching rubber at rear.

No. 12. Cut out landing gear struts.

No. 13. Cut out and assemble wheel pants.

No. 14. Carve propeller—Assemble shaft, washers and bearing.

No. 15. Cover each unit and spray with water.

No. 16. Assemble landing gear to finished body.

No. 17. Cement top wings in position.

No. 18. Cement lower wings in position.

No. 19. Cement struts in place.

No. 20. Attach stabilizer and rudder.

No. 21. Add rubber motor to the finished model.

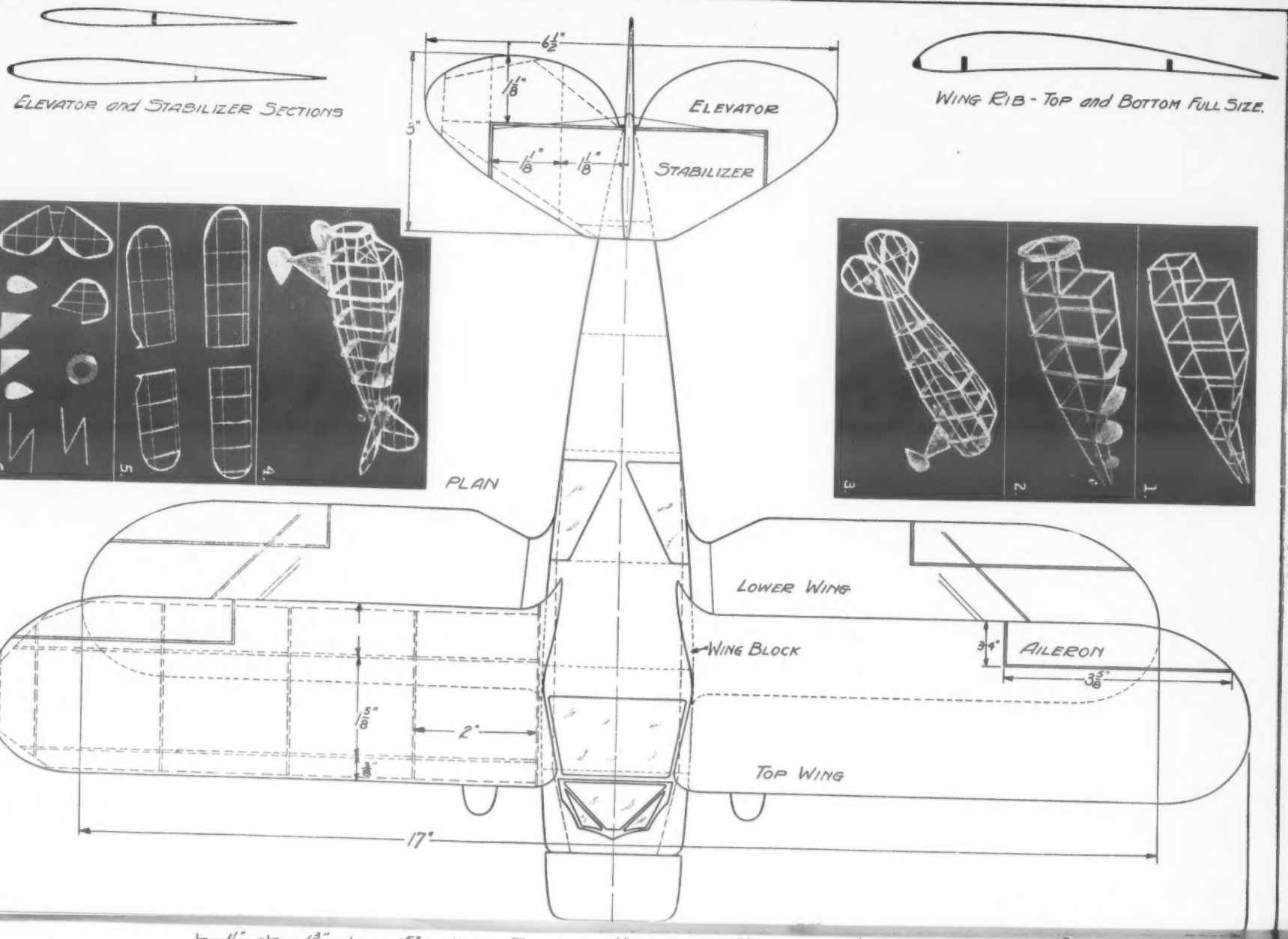
Constructing the Wings. Cut out the ribs to the full size pattern illustrated and after all the ribs have been sanded down to the same size, hold them together by piercing with a pin and cut out the position for the spars. The spars for the top wing are underneath the ribs, and the spars for the lower wing are on the top side of the ribs. In this way, a solid member is in position upon which to cement the struts. The wing tips are built up from small sections of balsa approximately $\frac{1}{8}$ inch thick. Note from the small photographs that the end rib which is cemented against the body is the same size. Because the body is a trifle narrower on the top side, the first rib on the inside of the top wings is $\frac{1}{8}$ inch farther apart.

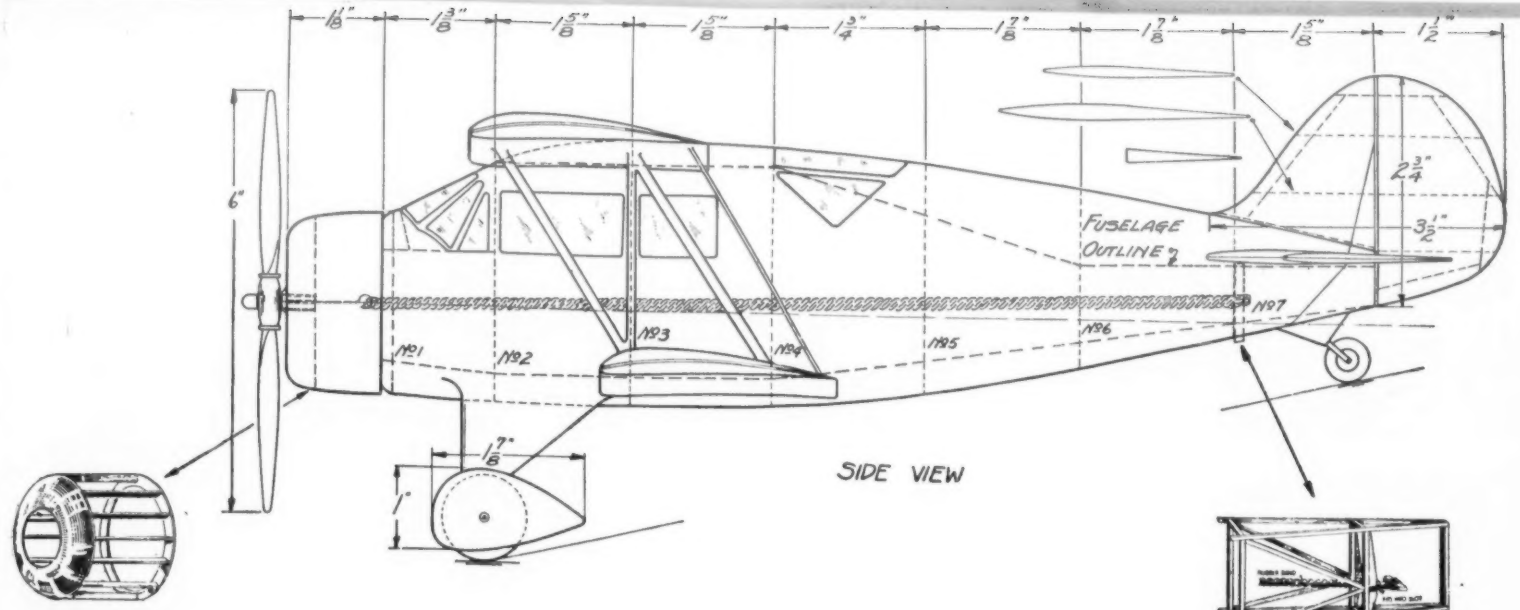
Constructing the Stabilizer. The

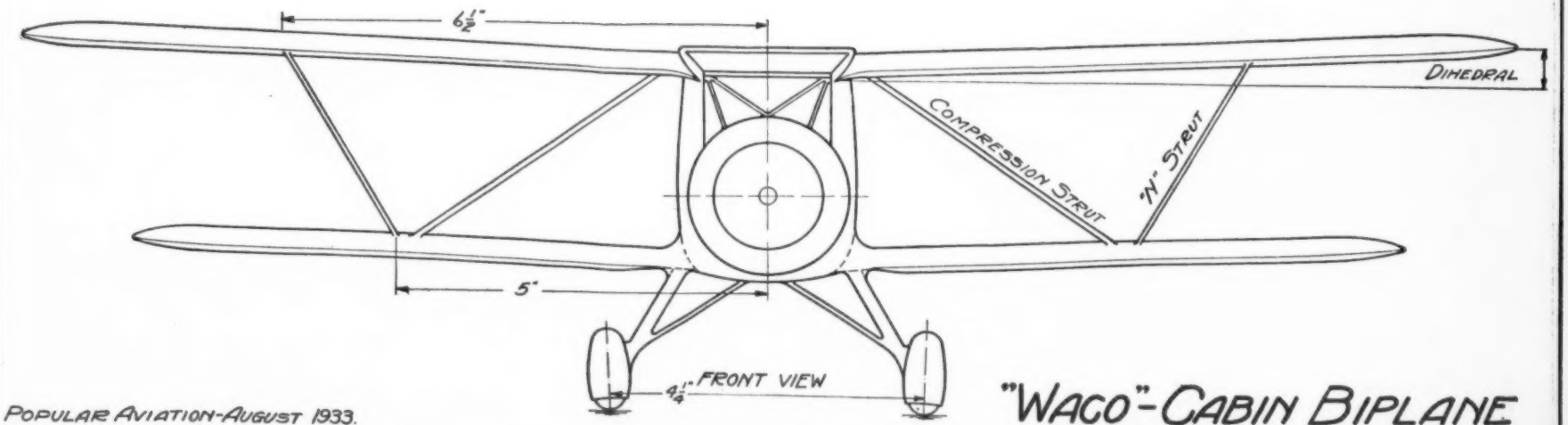
(*Continued on page* 122)

LIST OF MATERIALS

Longerons	3/32 x 3/32 x 18"	Balsa	8
Propeller	7" Diameter	Balsa	1
Spars	1/16 x 3/32 x 18"	Balsa	1
Entering Edge	3/32 x 3/32 x 18"	Balsa	2
Trailing Edge	1/16 x 1/8 x 18"	Balsa	2
Fairing Strips	1/32 x 1/16 x 18"	Balsa	4
Struts	1/8 x 2½ x 3"	Balsa	2
Ribs, etc.	3/64 x 3 x 18"	Balsa	1
Shaft	.024" Diameter	Wire	1
Bearing	Turned	Wood	1
Washers	1/8th Inch Diameter	Brass	3
Wheels	1" Diameter	Wood	2
Wheel	1/8" Diameter	Wood	1
Pants Inside	3/8 x 1¼ x 2½"	Balsa	2
Pants Outside	1/16 x 1¼ x 2½	Balsa	4
Rubber	1/32 x 1/8 x 60"		1
Cement	Clear		1
Banana Liquid	Clear		1
Tissue	Red		1
Tissue	White		1
Windshield	Cellophane		1


ELEVATOR and STABILIZER SECTIONS
6½"
1⅛"
ELEVATOR
3"
1⅛"
1⅛"
STABILIZER
WING RIB - TOP and BOTTOM FULL SIZE.
5.
5.
4.
3.
2.
1.
PLAN
LOWER WING
WING BLOCK
¾"
AILERON
3⅝"
1⅝"
2"
⅜"
TOP WING
17"





"WACO"-CABIN BIPLANE

POPULAR AVIATION-AUGUST 1933.

Waco "C" Model

(*Continued from page* 119)

stabilizer is constructed in a similar manner to the wings with the exception that the spar remains in one piece and the ribs are only as thick as the height of the spar. They are cemented against the front and the rear. Note on the photograph that the small rib is placed at an angle near the center of the stabilizer to which the tissue is attached when covering. There is also a small cross piece cemented to these ribs a short distance back from the leading edge. This fits up against the body former at the rear of the fuselage. The entire outline of the stabilizer is made up of solid sections of balsa. The piece of balsa at the trailing edge nearest to the body is as thick as the spar and gradually tapers off to the same thickness as the rest of the trailing edge.

Constructing the Rudder. The spar in the rudder is in one piece and the ribs are cemented in sections similar to that described for the stabilizer.

Constructing the Body. The body is assembled in sections and the first step is to construct two sides of equal dimensions and length. In order to accommodate a flat section at the rear upon which the stabilizer and rudder rest, it was necessary to make a deep downward decline starting at the rear of the top trailing edge. This makes the body appear a little awkward during the first stage of construction. After the two sides have been assembled, the next step is to add the circular sections or body formers.

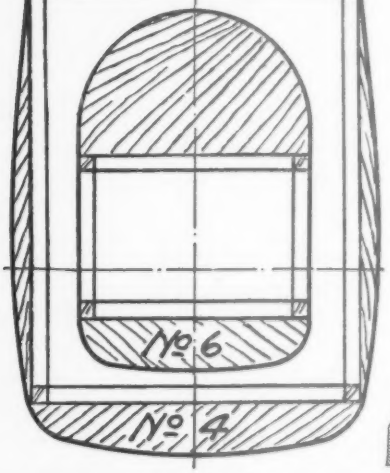
The first former, just behind the motor cowl, should be about ⅛ inch thick so that a slight curve towards the front can be secured and to which the streamlined cowl ring is attached. See the side view on the drawing for reference.

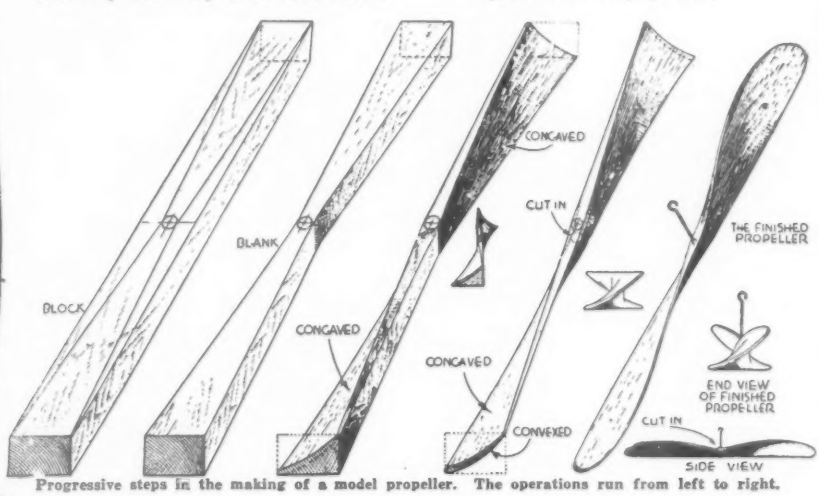
It is only necessary to add one or two small stringers on the side of the body but underneath three or four should be added and an equal number on the top side of the fuselage to the rear of the trailing edge. The rubber motor is reached from a position just in front of the tail wheel and the section at this point of the fuselage should be reinforced to withstand the strain of 3 to 5 strands of rubber.

The motor cowl should be a turned balsa section all in one piece, or if this is too difficult, make only the front part from a ½ inch piece of circular balsa, leaving the entire front solid and cementing a stiff piece of drawing paper the length of the cowl around the circular disc. Sand the front part of the ½ inch circular disc round. A wood nose bearing with a washer cemented over the hole to prevent the shaft from wobbling and the whole bearing unit with the shaft and propeller is removable from the front of the model.

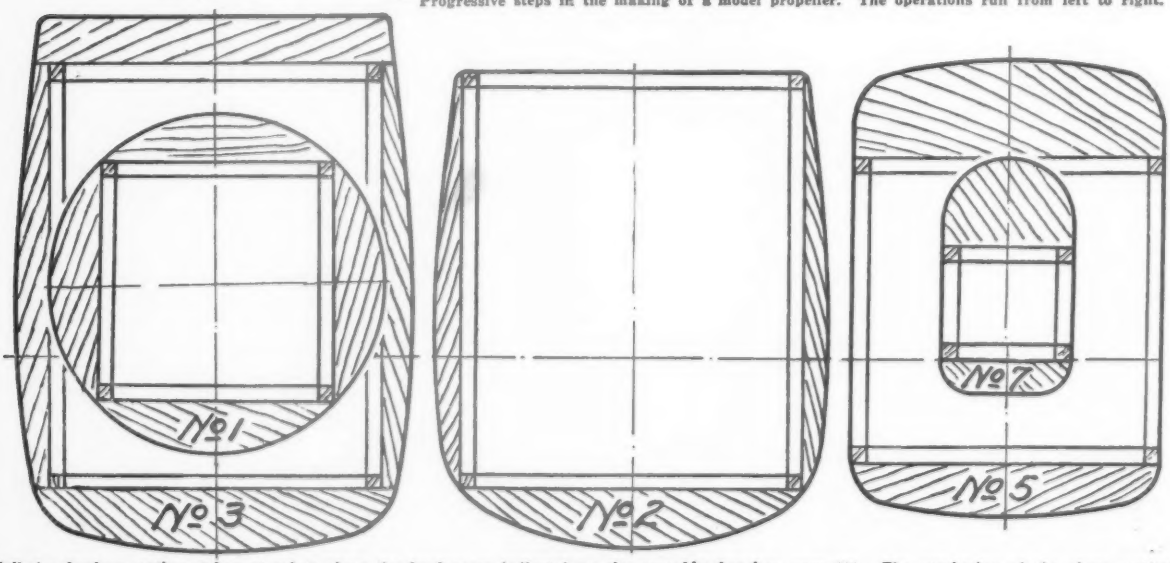
Constructing the Landing Gear. The landing gear on this model is very sim-

(*Concluded on page* 141)





Progressive steps in the making of a model propeller. The operations run from left to right.



Full size fuselage sections taken at points along the fuselage as indicated on the assembly drawing, page 121. The numbering of the above sections corresponds to the numbering on the assembly.

Sources of Power For Models

ABOUT every imaginable source of energy has been used for the propulsion of models from time to time with greater or less success, but rubber still stays with us in the majority of cases because it is simple, cheap and quite effective.

When we get into other forms of energy, such as compressed air, steam, gasoline engines, carbon dioxide motors or similar sources of power, the mechanics of the motor are generally beyond the equipment of the average home model shop and such parts must be purchased, either complete or at least partly machined. This is too much of an undertaking for many model builders and they then retire to the rubber strands again, all the while envying the fellows who are financially capable of putting on a real engine.

But believe me, boys, there is a whole lot of kick packed in the sight of an engined model flying along, powered with steam, gasoline or compressed-air. It is only by this means that we can successfully build big models up to ten foot span, and when we get up to these dimensions it is almost like flying a lightplane.

All in all, the construction of engine driven models is not so terribly expensive nor is it prohibitive for the fellow with almost any kind of a job, although it may be out of the reach of the juniors who must apply to "Dad" for the necessary construction funds. We don't know how a man with a love for model building can resist the temptation of laying the rubber bands aside for a time and taking up real power plants.

A fellow with a rotary engine of any type is quite fortunate for it gives him a chance to experiment with both compressed-air and steam as motive-powers. He can get a compressed air tank at a moderate price, pump it up to the required pressure with a bicycle pump and then turn her loose with more power than he ever commanded before. Or, else he can take this same engine and attach one of the new steam boilers or generators to it and get still more power and even more flying ability at a slightly increased cost.

Then come the small gasoline engines with their carbureter, spark-coils and gas-tank, just like a big engine brought down to model size. These little engines, generally rated at about one-eighth horsepower, will kick the ship along at a surprising speed and for even more surprising distances. The little engine will whirl the propeller like a good fellow and will tow along a big ship behind it.

We'd like to hear more from you fellows who have been playing around with real engines and give us your ideas and experiences on the subject. There must be at least 2,000 of these big models flying about, on a conservative estimate, and it seems that we should be favored with a few stories on the subject.

Building a Replica of the New Boeing Transport

by GEORGE HAYDEN

THE Boeing Transport presents a very simple solid wood construction model. The body should be cut from a rectangular piece of balsa tapering at the rear with corners slightly rounded. The wing should be constructed in one unit and a part of the body cut away into which it will set. The propellers because of their small size are probably the most difficult to scale.

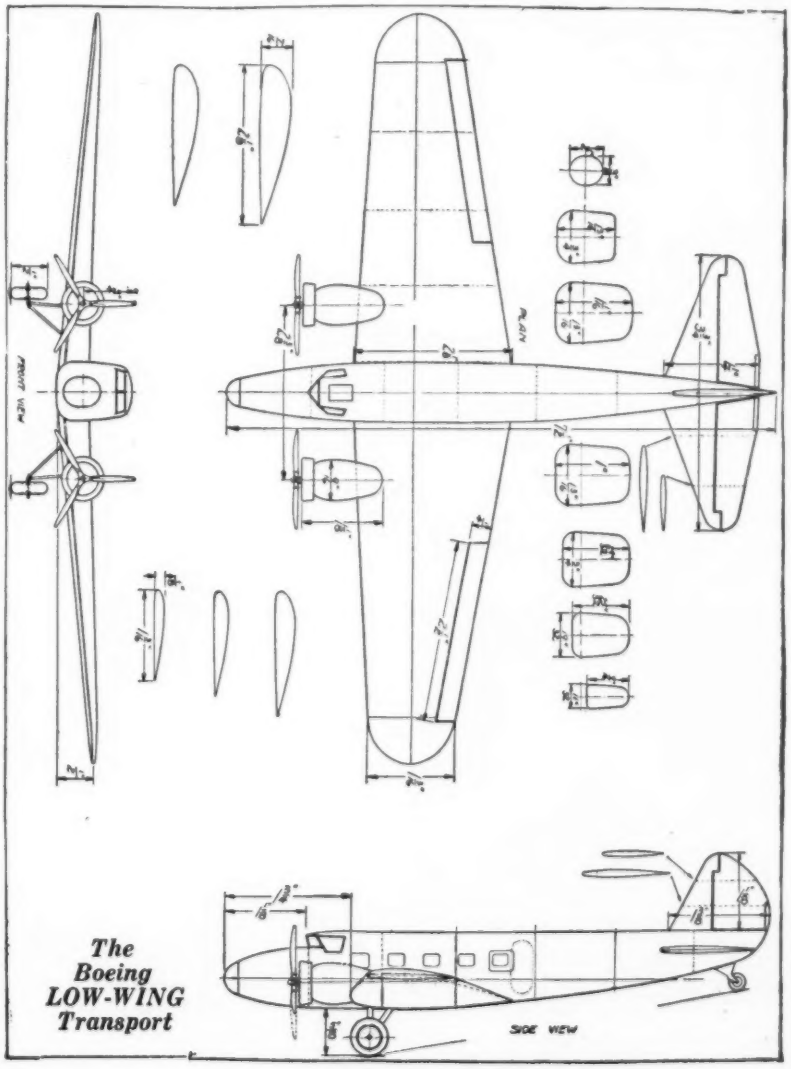
WING

The material for the wing is a piece of balsa 10 inches long, ½ inch thick and 2⅞ inches wide. First, shape to the general appearance and size as seen in the Plan View. The second step in the construction of the wing, is taken from the Front View and the dihedral on the lower side of the wing is worked into the piece of balsa. Also note that the top of the wing tapers slightly towards the center and downward.

After the wing has been shaped to conform to the Plan and Front Views, it is streamlined at five points to resemble the wing sections illustrated. To check the curves accurately, a cardboard template of ½ of the ribs on the top and on the underside is made and checked at the specified distances from the center. A small part of the wing at the leading edge and a small part at the trailing edge, is cut away the full depth of the wing and equal to the width of the body. This will then leave a solid section connecting the ribs about ⅜ inch deep, ¾ inch wide and one inch long. The wing should now be put aside and the body constructed.

BODY

The material for the body is a solid piece of balsa 7⅜ inches long, 1⅛ inch wide and 1 inch high. From this piece, the entire body is shaped to conform



to the body sections illustrated. Keep in mind that the body in its general appearance must conform to the Plan View and also to the Side View. The general shape of the body beginning from the cockpit to the rear is rectangular with rounded corners. The top part of the fuselage is a trifle narrower than the bottom.

To make the cabin and the windows realistic, the width of the body should be increased by 1/8 inch and cut in two, straight down the middle. After the cabin and cockpit sections are hollowed out, it is re-assembled. A slot is cut into the rear of the fuselage and into which the stabilizer and elevators all in one piece are cemented.

The cockpit is braced with small bamboo splints. Between sections (3) and (4) the lower side of the fuselage is cut away to receive the wing. Cut to fit as required by the depth and width of the section holding the wing in one piece.

STABILIZER AND RUDDER

The material for the stabilizer is 1/8 inch thick, 1⅜ inch wide and 3¾ths inch long. The shape of the stabilizer and elevators combined should be scaled from the Plan View. The sections are illustrated on this view also. The material for the rudder is 1/8 inch thick, 1⅛ inch high and 1⅜ inch long.

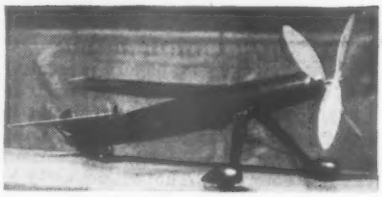
The correct shape of the rudder and fin which should be built in one piece, is taken from the Side View. Note that the body and the rudder finish off as one piece at the rear. For this reason the lower part of the rudder that rests on the body should be left thicker and tapered towards the top only.

LANDING GEAR

The landing gear is best constructed from heavy wire which is pierced into the wing and cemented firmly in place. The front wheels are ⅛ inch thick and ½ inch in diameter. The rear wheel is 1/8 inch thick and ¼ inch in diameter. The tail wheel is attached by a wire fitting bent to the shape and outline as illustrated in the Side View.

Here are the parts and the completed model of the Boeing Low-Wing Transport plane.

New Type Model



The two propellers of this ship remind one of the Italian record plane.

AN unusual flying airplane model, with twin propellers running in opposite directions, has just been perfected in Akron, Ohio, by Glen Rymer and George Wilson of the Rymer-Wilson Model Club.

The twin propeller feature of the design was suggested by the Italian speed plane which recently lifted the world's record to 423 m.p.h. The boys worked many hours perfecting and developing a gearing arrangement which would run the propellers, one clockwise, the other counter clockwise.

Torque is entirely eliminated by the use of two propellers, test flights of the model have shown. The craft will maintain an even altitude and fly in a practically straight line, much better than most built up models, it is claimed.

The model completed is 24 inches long, has a wing spread of 19 inches, and is equipped with shock absorber landing gear. It has flown straight at a height of about two feet for a distance of 100 feet, Rymer reports. It has neither elevators or ailerons.

Rymer, who recently won fourth prize in the International POPULAR AVIATION Contest, and who is a licensed airplane mechanic, recently left for Jackson's Mills, West Virginia, where he is to teach model building at the state 4-H camp. Wilson has also studied airplane design at an aeronautical school. The boys are in charge of what is probably the only full fledged model club in Akron.

About the Propeller

SO far, most model builders have unwisely neglected to pay as much attention to the propeller as this part deserves. They have fussed around with the fuselage and wings most of the time and then have stuck on almost any old prop that they can lay their hands on.

Now, this carelessness is often the reason why a well constructed model will not fly satisfactorily. The diameter may be wrong, the wrong pitch may be employed or the construction of the propeller may be at fault. If any such defect exists, then part of the power will be wasted and the desired duration or speed will not be attained.

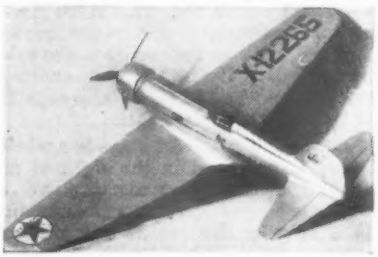
Even on big airplanes, the builders often have to experiment with various types of propellers until one is found that gives the best all around performance. There is no known rule by which the best prop can be calculated.

Models at the Fair

MODEL fans will have a feast when they view the big model display at the Century of Progress exhibition, Chicago. In the Air Show building there are literally hundreds of models.

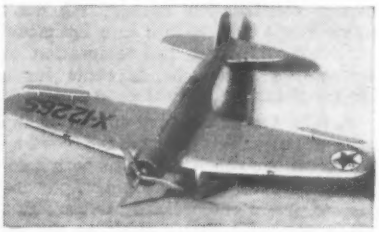
Many manufacturers have kits and supplies to show. Then, there is the POPULAR AVIATION display of the prize winning models from the International contest held last winter. Just across the aisle is a display of several hundred models entered in the Chicago Daily News contest.

Stunning Northrup Model



Rear plan view of the Hawks ship.

ALBERT MUELLER, 28 Peach St., Buffalo, N. Y., sent these two photographs of his beautiful Northrup model, the ship that is flown by Frank Hawks. A whole lot of time and work have been paid to the paint job as you can see.



Front plan view of the Hawks speedster.

Baby Curtiss Robin

This is the Curtiss Robin, not much larger than the hand that is holding it.

DONALD W. CLARK has built a small but good looking version of the Curtiss Robin, the size of which can be judged from the hand. He says that only 22 units have been employed in its construction. Very nice work.

These IDEAL *Kits offer more for a Quarter in every way!*

Your Choice of 8

Flying Models

25c

EACH POSTPAID

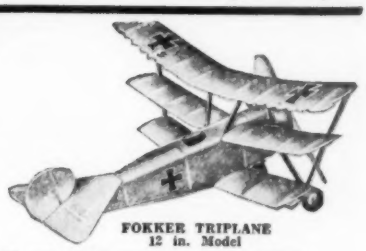
(No Orders for Less Than 2 Kits) West of Denver, 5c Extra for Postage. Stamps not accepted.

These are the Kits that made 25-cent Flying Models famous. Every one is a full-fuselage ship, with constructed body, built up cambered wings with special high-lift ribs, shock-proof landing gear, carved balsa propeller, stamped metal motor plate and many more fine fittings.

Kits are complete, of course, and include a big, 12½ x 13½ in. plan showing entire Model in full size and giving instruction for building. Also rubber, bamboo, cement, colored tissue, wheels, wire parts, etc. The most perfect and complete Kits you ever saw for a quarter.

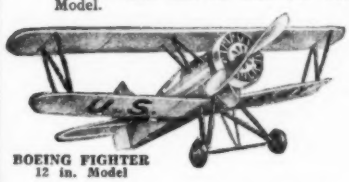
Build a fleet of these Models — they are all Guaranteed to Fly — and you'll have a whole summer's sport. Send your order now for the ones you like best.

PUSS MOTH
12 in. Model



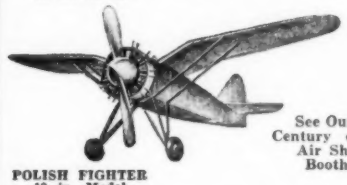
FOKKER TRIPLANE
12 in. Model

These are Guaranteed Flyers. They will hold their own against much more expensive Models and give you a fine performance in any company. You can have a whole fleet for what you would have to pay for only one expensive Model.



BOEING FIGHTER
12 in. Model

CURTISS SPARROW HAWK
12 in. Model



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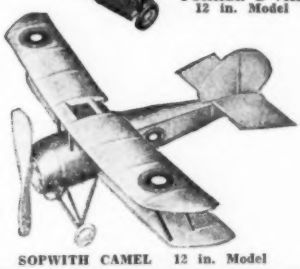

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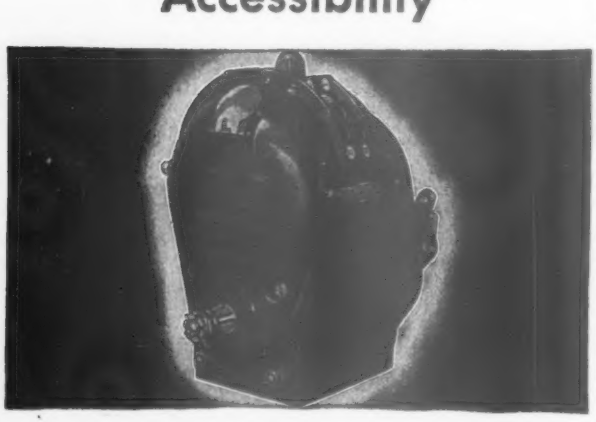

Southern News

(*Continued from page* 108)

out of being in the air. He decided that as he could run an automobile there was no good reason why he could not handle a plane and so "took to the air." Under the instruction given him by Les he became a proficient pilot and handled his own plane. The youngest pupil was a 16-year old boy,—one of the modern air-minded youth to whom flying came as naturally as running about on a bicycle.

Some of the women students have "caught on" very quickly and were easy to teach. Others did not grasp the fundamental principles so readily and proved to be greater problems.

But on the whole the women students have done remarkably well and Les has had the pleasure of seeing all his female pupils receive their pilot's license.

But he says that he much prefers to teach a man to fly than a woman, and for the reason that if a man does not behave or is dumb in learning certain things, then he can holler at them. But where the student is a woman, then he must be patient and control his voice! And for this reason Les prefers to teach a man than a woman!

But even though Les does think it easier to teach a man than a woman, his most exciting experience while in a plane with a student was when he had a man up in the air. Every instructor says that one of the first things a student must learn to do is to NOT freeze on to the control. That is the natural thing to do, but it is the wrong thing. Well, this particular student was up several thousand feet when the ship went into a tail spin. The man froze solid to the control.

Les tried to get him to release but without avail. Then he hit the man across the face with his hand, but the man remained solidly frozen to that control. And all the time the plane was descending. Les had been tightening a bolt in the plane and the monkey wrench was on the floor. He picked up the wrench and brought it down with considerable force on the skull of the student. The man slumped and Les was able to regain control of the ship and right her before any damage was done. This was one time when Les was glad that his student was not a woman!

The most peculiar pupil Les has had was a man who was most anxious to learn to fly. But after twenty-five hours instruction both student and instructor agreed that it was no use to go further; he simply could not learn to handle a plane. He could not take off nor could he land. This was the only student who absolutely could not learn.

The women who come for instruction are younger as a rule than the men students. That is, they average a younger age. Les has had no woman student over thirty years of age nor under sixteen. All come between these two limits. While an older man will take up flying as a hobby, the older woman so far has not expressed an inclination to do so.

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BERRY BROTHERS
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But it may happen in the future. Men of fifty or older if they have the money to spend on flight instruction usually have leisure to indulge their fancy. They are retired business men or professional men who are taking time off to play. And many of them are purchasing light planes which they will pilot themselves. The younger men are taking up aviation as a business or as an aid to them in their present occupation; the older men are making it a hobby.

Reed Becomes a Postmaster

UNABLE to get action upon his application for an airmail contract, but wishing to show its appreciation of a recent survey of air mail conditions, the postoffice department has made a novel move by naming Joe Reed, president of the Reed Airlines, postmaster at Lawton, Okla.

Reed was not among the 20 applicants for the position over which a bitter fight had developed. Reed was named to the post as a measure to assist him financially to keep his airline between Oklahoma City and Wichita Falls, Texas, in operation until his air mail plea is acted on.

"My interest is in the air line and it will be continued as in the past," said Reed. "I believe my mail hauling contract is reasonable and regard this appointment as a temporary measure only."

The postmaster job pays $3,600 a year. Reed recently has been in Washington in the interest of the mail contract. His revolutionary proposal is to carry all first class mail between Oklahoma City, Lawton and Wichita Falls by air at regular postal rates. His proposal figured out about 10 cents a mile, less than one-fifth of the average air-mail contract rate. However, Reed holds that this small amount makes the difference between profit and loss in operation of the line, which makes two daily round trips.

The government is reported interested in Reed's plan because of the location of Fort Sill at Lawton, and existing mail conditions.

Grants Licenses and Renewals

FOLLOWING two days of examinations and tests, A. M. Alcorn, division department of commerce inspector, has announced government licenses granted two persons and nine renewal licenses given at Oklahoma City, Oklahoma.

Joe Reinauer was given a private pilot's license while Charles E. Bradley was given a mechanic's ticket. Private licenses were renewed for James Brazell, James W. Clark, Charles M. Smith, Max Fife and Carl Haunt, the latter two from Blackwell, Okla.

Ship owners whose crafts passed satisfactory tests included: Roy Hunt, Great Lakes; John Burke, Travelair; Cliff Rowland, Parks; Braniff Airway, Inc., two Lockheed Vegas; Moss Patterson, Waco; Elmo Dodson, Curtiss-Robin, and Brazell, Waco.

END.

Airy Chat

(*Continued from page 82*)

gineers' expectations." According to this, the majority of our celebrated aeronautical engineers are not very accurate in making their estimates, or else they have been deliberately holding back on the dope until the last moment so as to show the boss a good time—or something.

* * *

WHERE are all of those Diesel aviation engines that were acclaimed as the salvation of commercial flying? About a year ago, there were a whole swarm of new Diesels on the market but they have apparently retired to that region known as "oblivion."

* * *

AS per advertisement, this issue contains an elementary article dealing with "levitators" which may or may not be the successor to the present air supported airplanes and dirigibles. Whether this idea will gain support is not known, but anyhow it is a good thought and well worth considering by our inventors.

* * *

Dear Old Lady: "Where do they carry the gasoline in this airplane?"

Pilot: "The gas tanks are in the wings, madam."

Dear Old Lady: "Well, I don't think that that is a very good arrangement for how could they get gasoline if the wings should come off?"—*Lifted from "Airways."*

* * *

THE return of 3.2 beer has given our airhostesses just one more problem to solve. Will they throw the empty bottles out of the window or will they serve draught beer from a faucet? Gee, I'm glad that I don't live under an airway.

* * *

IT is a fine idea to call in the Early Birds club for proving the authencity of an old plane or an early event in aviation, but I am afraid that this movement will be attended with difficulties. So far, I have never seen any two Early Birds that would agree with each other on any subject in its entirety. This is not a criticism—it is simply an observation.

* * *

IN the next issue we are starting a new feature series which is the result of repeated requests from many readers. It is a simplified course in aeronautics which starts from the beginning and follows the subject through to the last word in aerodynamics—written so that you can understand it. Hope you'll like it.

* * *

I BELIEVE that the emergency landing field situation could be simplified by laying a wide strip of concrete, 500 to 1000 feet in length, along our many highways at rather frequent intervals. The strips would be easy to locate from the air, they would make it easy to get assistance from passing motorists and would be far cheaper than the usual type of field.

* * *

WELCOME back home, Mr. McGregor—you've just made this issue by the skin of your teeth. We've been wondering what had become of you and your Kaustic Komments, in fact we were getting rather worried and afraid that you had lost your combative spirit.

Ladies and gentlemen, let me introduce Mr. Albert McGregor, the Flayer—or if you will have it so—the Imperial Razzer.

I declare a truce. Judging by your silence—more ominous with every passing sun—I suspect that you are highly disgusted with my remarks anent POPULAR AVIATION'S *many and varied little errors, oversights and bad illustrations. Alas, 'tis in me to criticise, but I'd much rather have you flay me (figuratively) in public or privately and I'm beginning to lose sleep over your sphinx-like muteness. O, say it isn't so. . . .*

I'd like to commend—not that he cares—Mr. Bollin, our Friend Herman, for his whopping cover of the April

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issue. Never thought it was in him. Undoubtedly, it's the swellest cover any aeronautical magazine ever displayed to an appreciative soul like mine. However, in May—"Will You Love Me in December As You Did in May?"—he shows a tendency to slide back to his little knack of making the illustrations more unnatural and stiffer than the hot dogs we get at the Yankee Stadium—and, Mr. Rathbun, you should see those hot dogs.

About the only time that I didn't agree with you—don't you feel simply awful?—was when you stated in the Airy Chat of May, among other slight disparities....."therefore, if you wish to fly your friends around in that new 2-place job, you'll have to run your time up to at least 50 hours."

Well, if you sit and ponder the question, the sensible reasoning of the new regulation cannot fail to hit you smack on the cobeza. None with less than 50 hours should be allowed to cart people around the sky and, while I'll fly with anybody in anything, I still think it foolish to place one's precious life in the hands of an Irish-green dodo with 34½ hours to his dubious credit. Notwithstanding, I am opposed to this "off-with-his-head" policy of the Department of Commerce and would like to be one of the first 500 in the Association. So, what's the membership dues?

Well, I've produced enough hot air currents in this letter to lift even an indecent piece of inflated gut like the "Macon"—will they never learn?—and so with best wishes and hoping the moths never occupy your chute (I can be original too), I am,

Sincerely,
Albert McGregor.

Albert, Albert! Do you mean to tell me, with all of your hair-splitting scrutiny, that you have failed to discover the cost of a membership in the L.A.A.? You've read her so close that you quarrel with a caption, but still you've failed to discover that the price of admission is one buck.

About the other matters mentioned, have it your own way. But with just a word in parting I would like to remark that no 10-hour fledgeling is half as over-confident nor so cocky and dangerous as the 50-hour know-it-all. It is a perfectly human characteristic that this should be so.

But annyhoo, A. McG., we're mighty glad to see that you are still on deck and still argumentative. That's the most important thing.

* * *

ALL this brings to mind that everyone does not agree with Mr. McGregor on the subject of the May cover design. Just to prove to Mac's satisfaction that the May cover has appeal and is not stiff, cold, and inert, we present the following excerpt from a letter received from a New York jeweler, Mr. William Barthman, 174 Broadway, N. Y., N. Y.

A customer of ours has given us a

May issue of the POPULAR AVIATION MAGAZINE, *on the cover of which is a picture of the new Chance Vought Corsair.*

We have received an order from him to make a model, in solid silver, complete in every detail from the plans given in the middle of the magazine. This model is to have a five inch wing spread and everything is to be made in perfect proportion.

When this is complete, it is going to be put on top of a very fine sterling silver cigarette box in the living-room of his home.

When this cigarette box is completed, we will be glad to print a photo of it in some future issue of P. A. Looks as if some of our readers liked the May cover, anyway.

* * *

WELL, here's a good place to quit for this month. Not for the reason that there is nothing more to chat about, but because we have reached the end of the space. C. U. L.

J. B. R.

Moisture

(*Continued from page* 116)

self-contained unit equipped with 135 volt "B" batteries. Since both neon tubes are operated on the same battery circuit, it is not necessary to calibrate the instrument to compensate for voltage drop of the batteries.

The hammer with which the lumber is struck is double-faced, made of treated wood. Small knife-shaped stainless metal electrodes, about one inch apart, project from each face of the hammer. From the instrument case a long, rubber-insulated, waterproof cable passes through the hammer handle to the electrodes. Since the electrodes are knife-edged and only slightly penetrate the wood, the lumber is not damaged by the tests.

The instrument reads between 7 and 24 per cent moisture content. A lower figure, which can be attained with special kiln-dried lumber, is difficult to hold because of the humidity of the atmosphere.

END.

Rockwell

(*Continued from page* 88)

FREAK incidents, however, were all a part of the game. Rockwell recalls with gusto the story of Courtney Campbell who dropped the lower left wing off his Nieuport. Had the wing fallen completely off, Campbell might have righted his ship with greater ease. But the recalcitrant wing flopped in the wind and repeatedly struck his flying wires. Campbell, despite the serious loss of lateral stability, jerked his ship so violently that the wing finally did drop off. And he landed the Nieuport safely—only to fall later in the pursuit of routine patrol duty.

Col. Rockwell still flies. He has to, as commander of an army reserve unit. And he gets a great kick out of watching every new development in military flying. His passport shows that he sailed for France on the 13th of the month—March, 1915—and returned to America for final discharge on the same day four years later. As Number 13 man of the Escadrille, he never found his number unlucky. But he won't light three cigarettes on a match and don't ask him to.

He began flying just after men went aloft in ships that resembled the early Wright biplanes and blazed away at each other with shotguns, rifles and revolvers. He went through the transition period of aviation, saw the war fought in Nieuports with their tremendous torques, and watched the Atlantic and Pacific being crossed. And he doesn't doubt ocean air lanes are a thing of the near future.

END.

Air Show

(*Continued from page* 101)

test models and trophies are exhibited. These are the prize winning models from the POPULAR AVIATION First International Model Airplane Contest held the first of this year in Chicago, well worth seeing. This is the booth where you readers will be welcomed and where we will expect you to turn up when you attend the big show.

Not all of the exhibits are mechanical by any means. There is always a creditable sprinkling of persons well known in aviation circles. There are U. S. Army Air Corps officers, members of the Early Birds club, old time stick-and-rudder men and all the rest of the fraternity. Prominent among the bunch is Ed Nelson, an Early Bird, who erected the ships in the exhibit.

Outside of the building, but close to it is Pal-waukee Airport Seaplane Base where a Sikorsky amphibion is busy hustling passengers all day. Then there are the two Goodyear blimps also carrying passengers and some distance down the road is a kite balloon in which you can ascend at a moderate fee.

If you don't see what you are looking for, come to P. A.'s booth and it is very likely that we can tell you where to find it. So long—see you at the Fair.

END.

BOOKS

We May Have Just the Book You Have Been Looking for

We must reduce our overstocked bookshelves. Many standard books will be sold far below list price. We will not replenish this stock so take advantage of this opportunity to get that book you have been wanting. We have books on all phases of aeronautics. Write us your needs.

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Tail Group

(*Continued from page* 110)

the section must be thin—say about ½ inch thick at the rear stabilizer spar. If a cantilever tail is used, the surface must be about one inch thick at the rear stabilizer spar if of steel, but about two inches thick if a wood type cantilever surface is employed. The wood stabilizer is much lighter than the steel cantilever tail.

In Fig. 2, each elevator has an area of about 2¼ square feet, therefore, one-half of the stabilizer has an area of 3⅛ square feet. In designing the spars we deal only with one-half of the surfaces since each half is the same shape and area.

If a 50 h.p. engine is used, we assume a load of 35 pounds per square foot according to the rules of the Department of Commerce. If this ship has 100 square feet of wing area and only 40 h.p., we would assume a load of 23 pounds per square foot of horizontal tail area. This is reduced to 19 pounds per square foot of horizontal tail with 150 square feet of wing surface and a 30 h.p. engine.

The stabilizer spars in Fig. 2 are 8 inches apart, and the area between the spars is divided so that half the load is supported by each spar. For this reason, the rear spar supports the elevator and part of the stabilizer, or 2¼ plus 1 is equal to 3¼ square feet. The front spar carries 2⅛ square feet.

Multiplying these areas by 35 pounds (required for fast ships) we obtain a loading of 115 pounds for the rear spar and 75 pounds for the front spar. Before building the stabilizer, we can test the spars by loading them with sand bags, distributing the 115 pounds on the rear spar from the center out to the tips. This totals 230 pounds for both halves of the stabilizer. Do the same with the front spar, see Fig. 3.

When welded steel tubing is used, the Department of Commerce allows us a 20 per cent loss in the strength of the tubing to compensate for the loss of strength due to softening of the steel at the point of welding. In other words, the tubing is designed to take a load 25 per cent greater than actually necessary for the whole uninjured tube.

This means that the tail is heavy, but if we use chrome-molybdenum tubing, which is stronger but more expensive than the carbon steel, we can use smaller tubes and thus obtain a lighter tail than possible with the ordinary carbon steel.

SIZES FOR WOOD CANTILEVER TAIL

Rear stabilizer spar, ⅜ inch thick. Weighs 1 pound. See Fig. 2.

Front stabilizer spar is ¼ inch thick and weighs ½ pound.

Both spars are of the best quality straight-grained clear spruce.

SIZES FOR CANTILEVER STEEL TUBE TAIL

Rear stabilizer spar tube, 1 inch outside diameter x 16 gage wall. Low carbon steel tube weighing 4 pounds. Using chrome molybdenum steel, the tube will be 1 inch outside diameter x 20 gage wall and weighs 2⅛ pounds.

Front stabilizer spar tube. ¾ inch outside diameter x 17 gage wall. Low carbon steel, weighs 2½ pounds. If of chrome molybdenum steel, is ¾ inch diameter x 22 gage wall and weighs 1¾ pounds.

EXTERNALLY BRACED TAIL SURFACES

Rear spar take ½ inch outside diameter tubing x 18 gage wall, low carbon steel. Weight 1½ pounds. Using chrome molybdenum steel, the outside diameter of the tube is ½ inch x 22 gage wall, weighing 0.85 pound.

Front stabilizer spar has an outside tube diameter of ⅜ inch x 22 gage, low carbon steel. Weight 10 ounces. This is the smallest diameter and wall thickness recommended so that chrome molybdenum steel would not show any improvement for this spar.

Looking over the data presented here, we see that wood is the best material for lightplanes for it is stronger for its weight, and in lightplanes we cannot afford excessive weight. Wood is also cheaper than steels and is also easier to repair in the field.

The spars of the vertical tail surfaces can be made of the same size as the spars for the horizontal surfaces given above. When testing the vertical tail surfaces, only 70 per cent of the load required per square foot for the horizontal surfaces is required. For example, if 35 pounds per square foot is required for the horizontal tail surface, then the loading per square foot on the vertical surfaces will be: 35 x 0.75=26.35 pounds per square foot.

This gives you the necessary information on the method of attacking the design of a tail surface, although the method of determining the stresses on the spars is far too complicated to take up at this point without further instruction. Therefore, I have given the size of material without showing how the size of the spars was arrived at.

END.

Sportswomen

(*Continued from page* 106)

has charge of the central reservation control board for the Eastern Air Transport Co., Richmond, Va., from where the company's lines branch out in four directions.

The space in an airliner is limited to a minimum number of seats, therefore the control of reservations must be handled with a maximum of efficiency. Planes must not be undersold, and they dare not be oversold.

Mrs. Saunder's working equipment consists of two teletype machines, a direct telephone to the company radio station near the Richmond field, a Postal Telegraph printer and a space chart book.

Along the rest of the system there is a highly organized radio communication system. The teletype machines send impulses over telegraph lines and write out messages on all machines connected with the circuit. Thus any station can communicate instantaneously and directly with Mrs. Saunders and other stations at the same time.

Mrs. Saunders uses the radio to communicate with eleven stations on the line that are not equipped with the teletype machines, and with the telegraph printer she can speed telegrams to other airlines.

END.

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July 15th and August 1st issues.....50c

THE MECHANICS PRESS, University Station, Madison, Wisconsin

ORDER AT ONCE

Steam Planes

(*Continued from page* 106)

is tremendous, often running above the first cost during the life of the engine. This life at its best is not long compared with the life of steam engines which simply go on for years and years.

It is these factors of first cost, higher maintenance and higher depreciation which make it so necessary to save the last ounce in construction in favor of pay-load. I once put this problem up to one of the most eminent engineers in this country and he didn't answer me directly, he simply wrote some figures on a sheet of paper and handed them over to me. "That's your problem," he said. The figures represented the difference between the weight of the plane and its power plant and the load it could carry, which is called pay-load.

"That figure must be kept as high as possible," he said, "And with a steam engine you haven't a chance."

I replied that I thought he was starting at the wrong end of the problem. Only because of the cost factors listed above was this absolutely necessary. Supposing we could cut the first cost in two. Supposing we could divide the maintenance cost by ten. Supposing we could cut the depreciation four-fifths. Then the pay-load factor would not need to be so high. He agreed to that, but still did not consider the proposition practical. I leave this point for my reader to decide.

The question of fuel is of paramount importance. Except in the Diesel type of engine, the fuel used must be the best grade of gasoline and carefully filtered to be free of both dirt and water. And many is the crack-up which has been attributed to a very small amount of either impurity. The question of fuel cost has been one that has seemed to intrigue engineers from time immemorial.

It was the first and only claim to a consideration of the internal combustion engine. The theory of burning fuel inside the cylinder walls of the engine sounded good to the engineers in those days and all the effort and all the money spent on the development of the internal combustion engines owes its beginning to this one fact, as most certainly compared with the steam engines of that day, there was nothing about the explosive type of engine to recommend it to anyone's consideration.

The fire hazard is a matter which must receive serious consideration in airplanes. If your plane catches fire you can't just jump out and run away and I presume that no form of accident is more dreaded by aviators than that of fire. Let us compare the liability of fire in both types of power plants.

Your gasoline driven plane may be seen at night by the trail of orange and blue fire emitted from its exhaust. Its exhaust pipes are hot enough to ignite gasoline or oil, if it is dropped or sprayed on them. In our steam plant we will have a fire which will be as fully enclosed as is that in a gasoline engine cylinder. It will be surrounded by tubes full of water, much as the water-jackets on a water cooled engine.

The heat from this fuel is absorbed to such an extent in its passage through the steam generator unit that the resulting escaping gases are very low in temperature. The fuel itself need not be gasoline but a comparatively low gravity oil which will only burn when properly kindled.

END.

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Marvin A. Northrop Aeroplane Co.

Minneapolis, Minn.

Mosquitoes

(*Continued from page* 108)

to the preparation. The effectiveness of the treatment was destroyed after a few hours, due to the fact that the dust particles absorb moisture, sink in the water and carry the Paris Green along with them.

The semi-success of the Paris Green experiments led to further research, however, and flyers and Medical Department men of France Field believe that the problem has at last been solved after many months of work.

Oil sprays have answered the question. An observation plane equipped with specially developed apparatus now makes periodical anti-mosquito raids and success is predicted.

Ed Nelson

(*Continued from page* 110)

member, you were instructor yourself at Bud's.

"When this school broke up, I started the Rockford-Beloit-Janesville Airline, the first scheduled passenger-carrying line in the United States. We maintained a two-hour schedule and the service wasn't bad for those times. That was in 1920, the same year that I started the first high-school aeronautical course in the U. S. at Beloit, Wis."

"Well, what then," I interrogated.

"There must be something else."

"You bet. I soon discovered that it was a little too early to start an aerial transportation system, the public hadn't been educated to it, and so I started a five plane flying circus that continued through 1921, 22, 23, 24. This was a great business, but in the course of time, everybody had seen at least one cow-pasture dog-fight and the business fell off to zero."

'Then I started the South Bend-Michigan City-Laporte-Chicago passenger and express service in 1925. Then—"

"Oh, never mind the rest of it," I said. "You're getting down to modern times and anything that happened after 1925 don't matter. So long, old-timer."

Ed Nelson, known to all of the old-timers, has stuck more consistently to aviation during all these years than any man I know of. He stuck with it when it was fat and when it was lean. He is a symbol of an abiding faith in the airplane. He is for the whole game —except for wing-walkers and parachute jumpers.

END.

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MORRISON HOTEL
CHICAGO

Wartime Junk

(*Continued from page 92*)

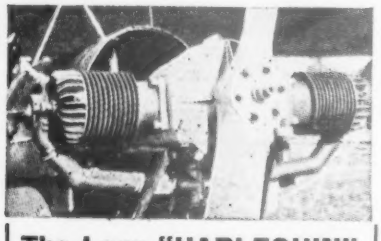
these rotary powered ships had a combination throttle, one for spark and the other for gas. This made it possible to run as many cylinders as you wished. Therefore, if it was necessary to cool the engine in mid-air, you could run on two or three cylinders.

The danger was, that after setting your spark for two or three cylinders, if you failed to set the gas down to the two or three cylinders, the cylinders which were not firing were getting gas just the same. Then the gas would come out of the end of the cylinder where the exhaust port was located, and the centrifugal force sprayed it around inside the cowling.

As it dripped out of the bottom it would be ignited by the cylinders that were firing. As long as you used your head in operating your throttles you were all right, but it is human nature for people to forget once in awhile.

While it is compulsary today to carry a fire extinguisher in all licensed aircraft, these are ordinarily on a bracket in the cockpit by the pilot's seat and not connected to the engine. The Tommys had their extinguisher in a bracket which could be pulled out and was connected direct to the engine by a metal tube which went through the fire wall. By pumping the handle the entire engine could be flooded with pyrene in case of necessity.

END.



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LES LONG
CORNELIUS, ORE.

Corben

(*Continued from page 115*)

In the event you do not care for them it is not necessary to pay any attention to the welding and tapping of the two ⅜ inch tubes or any other parts which deal solely with the dual part of the controls.

After you have the controls finished, the next step is the landing gear and shock struts. These details are shown on Drawing 606. Note very carefully the landing gear assembly. Study it over before you try to start the actual work. Trace down all of the details and after you have a good picture of the details in your mind, make a full size layout of the front strut and axle, it is a good idea to make this layout on a sheet of Asbestos, after it is finished lay it on a board or work bench and cut and fit the tubes as shown, lay them all in place and tack weld each piece taking care that you get all of the angles correct. To hold the pieces in place while tacking, a jig can be made by driving nails around the tubes.

After all of the pieces are tacked, take it from the jig and proceed to build up a second front strut the same as the first. Now weld up all joints as shown after which you put the struts onto the fuselage fittings and bolt them in place. Try to set them at the proper angles as shown in the front view, being sure they set 90 degrees in relation to the bottom fuselage member when looking at them from the side. Cut and fit the rear struts as shown, tack weld the top fitting in place and bolt it to the fuselage fittings.

Next tack weld the rear strut to the front and when you are sure that everything lines up as it should, weld up all of the joints while the assembly is still on the fuselage, if you don't do this, you will find that when you do the welding, the tubing will shrink, the result being that your landing gear will have to be sprung when you put it back on the fuselage. This will weaken the landing gear considerably.

After the welding is completed, weld the ⅝ inch tube across the top as shown, this little tube has a dual purpose as it not only straightens the landing gear but holds the streamline covering along the top of the landing gear.

The shock-struts are next and should be made up by cutting the bottom tube first and welding washer No. 606-20 to the top after which the weld should be filed smooth so that the lower tube will slip freely into the top tube as shown in the cut away section of the strut assembly. Weld washer 606-5 to the lower tube as detailed. Be sure to weld around the top only so the washer will set down onto washer 606-4. The bearing is now welded to the bottom of the tube and gusseted as detailed. The next step is the top tube, which you will note, extends down approximately half way into the assembly. Weld the top bearing and gusset, weld washer 606-6 in place, now weld the large 2 inch tube to washer 606-6.

Drill a small hole and solder a zerk fitting in place as detailed. Now insert the small spring in the top tube as shown, place the large spring in place and slip the lower tube into the assembly. (Note: washer No. 606-4 should be slipped onto the lower tube before washer 606-5 is welded.) The shock strut is now put into a large clamp and compressed, and washer 606-4 welded to the 2 inch tube as detailed. It is necessary that the strut be compressed so the heat from the welding will not take the temper out of the spring, be sure the weld is cold before the clamp is taken off. Make up the second strut in this same manner.

We have one fitting to weld to the landing gear which is No. 606-7. Cut and shape these fittings as detailed. Put the top of the shock strut in place in fitting 607-6 and run the bolt through the top hole of the strut. Now bolt fittings 606-7 to the bottom bearing of the shock strut and line up on the landing gear as shown. (It will be necessary to cut the rear fitting to fit over the rear landing gear strut.) Weld the fittings in place. Make up the hub caps and drill the axle for the ¼ inch bolt as detailed and your landing gear is completed, ready for the fairing. Give all metal parts and tubing a coat of rust proof paint after finishing, being sure that you wipe or burn off all oil coating which is on the tubing before you do any painting.

As a few parting words, you will notice the steel specified is S. A. E. 1025 which is a high carbon steel, the tubing is also of the same specification and you should make sure that you obtain this kind of steel or you will find that your ship will not stand the gaff. There are two kinds of tubing on the market, welded and seamless, make sure that you purchase the latter as the safety factor of the Junior Ace is figured with seamless tubing and regardless of what some people may tell you, welded tubing does not embody the strength of seamless tubing.

END.

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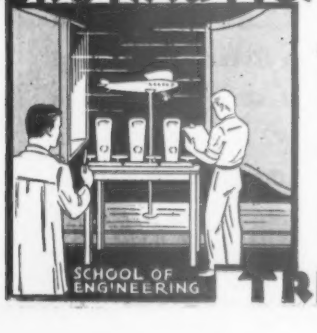

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TRI-STATE COLLEGE

Q & A

(*Continued from page* 104)

temperatures with higher altitudes. It may surprise you to know, that when the atmospheric pressure is reduced to 0.03 mm. of mercury, that water will boil itself into ice at 32° F.

* * *

QUESTION:—Alex. Smith, Jamestown, Va. (a) *Does an ordinary type of magnetic compass ever point true north?* (b) *Does a gyroscopic compass point straight north?*

Answer:—(a) THERE are only a few places in the United States where the magnetic compass points true north, and these locations change from year to year. A gyro compass will point true north when adjusted to run at true north, but it has no power within itself to turn itself to the north or any other direction. It is set into the proper direction by hand, and then it continues to hold this position indefinitely.

* * *

QUESTION:—Lon Schmidt, Milwaukee, Wis. *Is there any simple proof that a long slender wing of high aspect ratio presents less resistance than a short stubby wing?*

Answer:—YES. Cut out a long slender model wing having an aspect ratio of 10 or greater, and pivot the wing so that it is free to swing around in a horizontal plane. When the model is placed in the wind, it will immediately swing around broadside-on to the wind, showing that the resistance is less in this direction than with the narrow edge forward.

* * *

QUESTION:—Alvin Strohmer, Santa Barbara, Calif. *If pure oxygen were used in place of air from the atmosphere, would the efficiency of a gasoline engine be increased?*

Answer:—YES. Atmospheric air contains about 23 per cent of active oxygen and 77 per cent of nitrogen and other inert gases. This means that more gas must be heated up in the cylinder, and when rejected through the exhaust, carries away just so much more heat than with pure oxygen.

* * *

QUESTION:—J. J. Symington, Spokane, Wash. *At the present time we have adjustable pitch propellers that are manually adjusted by the pilot in flight. Have automatically adjustable propellers ever been proposed or tried out?*

Answer:—YES. The earliest was the Breguet of 1912 with which movable steel blades were controlled by springs so that the pitch was always in proportion to the tractive effort. Since that time, numbers of automatic props have been proposed, both in wood and metal, but for some reason or other never reached production.

END.

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IN THE
September Issue of P. A.

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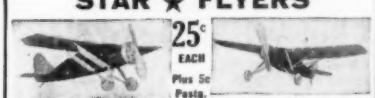

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AIRPLANES

FALCON CABIN PLANE, new 2-place job, new 4-cyl. opposed air-cooled engine, metal or wood props, air-wheels, ailerons and tail-group uncovered but have grade A covers sewed up. I would like to swap this ship for a heavier plane in good condition, licensed or unlicensed.—H. J. Thomas, 214 E. North St., Winchester, Ind.

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MONOPLANE WANTED, a good 2-place high-wing monoplane with a Continental A-40 engine or similar engine. Must have steel fuselage. Will trade 4-acres of land with a new 2-room house in northern Minn. Good hunting.—C. O. Laurie, Penasse, Minn.

AMERICAN EAGLET, damaged but licensable. Has had only 100 hours. Will trade for a car. —Wallace Ang, Route 4, Rockford, Ill.

AERONCA C-3, licensed and in good condition, not much time on it, in perfect condition and has several extras. Will trade for a good Great Lakes or a Jacobs Spartan.—Box 1108, University, Virginia.

LIGHTPLANE WANTED, lightplane parts or engines. I have a Harrington and Richardson, 0.32 revolver, plans for the Guardian Lightplane, etc.—Chas. d'A. Courtenay, c/o Popular Aviation.

LIGHTPLANE WANTED. Will trade a $98 radio, radio parts, etc., with extra cash if plane is worth it.—Harold Frey, 968 Oxford Road, Cleveland Heights, Ohio.

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AIRPLANE WANTED, a Jenny, Standard, Canuck or Oriole, with or without engine. Will trade one beautiful model of a locomotive, electric, with car. Finished in nickel and brass. If your plane and engine are in good condition will add cash.—Bill Rohde, 112 Circle Drive, Teaneck, N. J.

LIGHTPLANE WANTED, a damaged ship, preferably a Heath. Will trade a motorcycle, bicycle parts, radio, correspondence course, gold watch, etc.—Paul Hughes, 538 Main Ave., St. Maries, Idaho.

OX-5 EAGLEROCK, finished in red and cream lacquer. In good condition. Will trade for a car.—Wm. McMahon, 711 Tyler St., Gary, Ind.

LIGHTPLANE WANTED, a Heath Parasol, Aeronca or similar factory built job. Will exchange an excellent '27, 74 Harley-Davidson motorcycle, just overhauled with new bearings and valves. In A-1 condition.—S. H. Schontz, 324 S. Dorcas St., Lewiston, Pa.

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AIR CAMPER PARTS WANTED. I have a plane, less engine, wood construction, to trade with some cash if necessary.—Chas. Mutter, Comstock, Nebr.

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PIETENPOL SCOUT BLUEPRINTS WANTED. What do you desire in trade?—J. Correale, 3006, 33rd St., Astoria, L. I. City.

TRAVEL AIR PARTS. 2,000 Travel Air parts to exchange for Bird parts, or what have you? Will also trade for crack-ups. What do you want for the latter?—Crane Garage, J. Swedler, 816 Crane Place, Toledo, Ohio.

WINGS WANTED. Need two Hess Bluebird wings. Will exchange one left upper wing, four ailerons complete, complete tail surfaces, landing gear (less wheels and tires) and radiator for an International F-12. I also need instruments.—Robert Baker, 735 Market St., Wheeling, W. Va.

HEATH WING, partly assembled. What is your offer for this wing?—McDoriel, R-1, Itasca, Tex.

WANTED, helmet and goggles or old plane parts. I have a crystal set, a large assortment of stamps and a few old aviation magazines to trade.—Erwin Krebs, Syracuse, Nebr.

HEATH WING PANEL, complete, to swap for 4 26 x 4 wheels, tires and tubes. Also wish a Henderson prop, fuselage, tail assembly, engine mount and landing gear.—S. J. Tussy, Devol, Okla.

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1929 CHEVROLET SEDAN, good condition, four new tires, Stromberg carb., new shackles. Will trade for a 2-place lightplane, suitable for training. Prefer one licensed or eligible for license. —Wayne Bristol, Cady Route, Valentine, Nebr.

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MAGAZINES, 14 Street and Smith publications and a complete home-study flying course. Valued at about $2.50. Will trade for a balsa wood cutter, model supplies or any good aviation book.—Alan Tyhurst, Box 2224, Fielding, Sask., Canada.

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MAGAZINES. Have 28 copies P. A. and 32 copies Model Airplane News. Want goggles, helmet or flying suit in exchange.—Charles Proctor, 31 N. Central Ave., Canonsburg, Pa.

BOOKS. Have books and stamps to trade for high school text-books. Send for list.—Melvin Smith, 1234 Markley St., Norristown, Pa.

BOOKS. Man's Wings, How to Fly and 1932 Flying Manual. Also an Alumaweld solder kit with soldering iron. Will trade for racing goggles.—Anthony Base, 212 N. Aurora, Ithaca, N. Y.

BOOKS. Bishop Murder Case, Greene Murder Case, The Last Flight, Red Knight of Germany, finished model of Albatross D111, Semi-finished fuselage of Cleveland Gee-Bee, plans for any 6" model. 5 Jig saw puzzles, Autogiro model completa. What have you,—Paul Stein, 1381 Broadway, Brooklyn, N. Y.

MAGAZINES WANTED, Pop Aviation, Pop Science, Pop Mechanics, QST. Will trade 6 steel traps for 6 copies or two pair of No. 11 ice skates for 14 copies.—John E. Knaul, 7360 Kirkwood Lane, Cincinnati, Ohio.

MAGAZINES. Three issues of Pop Mechanics for issues of Aero Digest or Pop Aviation.—Carl P. Clement, 136 N. F St., Tulare, Calif.

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MAGAZINES. 90 magazines, mostly Pop Science, Pop Aviation and Aero Digest. What have you —Lyle Hoover, R-7, Princeton, Ill.

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MAGAZINES. I have 8 English air magazines containing drawings of modern English and American planes. Will swap for four issues of Pop Aviation. Prefer Jan. to April, 1933.—D. H. Shirley, 41 'N. Sutton Bldg., Chelsea, London, England.

MAGAZINES. Will trade Adventure, Argosy, Pop Aviation, National Geographic, Golden Book, Police Gazette, and others, for Sportsman Pilot, Short Stories, Aero Digest, Aviation, Cosmopolitan, Motion Picture, Mid-week Pictorial, Buffalo Bill Weekly and Time.—E. A. Kuehl, Holstein, Iowa.

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MAGAZINES. 14 Pop Mechanics, odd issues of 30-31-31, 2 Modern Mech, 1 Sky-Fighters, 1 Boy Craft book, 1 Daisy air rifle. What have you? —Ray Beves, Jr., Elkland, Pa.

MAGAZINES. I have about 45 air fiction magazines, a few Western and Detective mags, and four issues Model Airplane News. Will trade for issues of Pop Aviation before 1928 and between August, 1929, and March. 1932. Any other aviation magazines, not fiction, can be used. Will trade them cost for cost.—Henry F. Cordes, Box 2, Hayward, Garfield County, Okla.

MAGAZINES WANTED. Pop Aviation for July, 1930. Will swap four numbers of Flight (London) for them.—Jesse Schmidt, R-2, Box 161, Santa Cruz, Calif.

MAGAZINES. Have 16 Pop Aviation, 11 Universal Model Airplane News, also the 1933 Flying Manual. What have you?—Robert Utratjl, 165 West End Ave., Brooklyn, N. Y.

MAGAZINES. Have 12 different flying magazines and many photos of planes. What have you?—Joseph Feder, 2618 S. Sixth St., Philadelphia, Pa.

MAGAZINES. A number of mags including science, aviation and fiction that I would like to exchange for a scale model, or what have you?—Ellsworth Francis, 16 Orchard St., Salem, Mass.

100 MAGAZINES (Westerns), Radio News, QST and a book on amateur radio to exchange for a used course in aviation.—Donald W. Jackson, Skowhegon, Maine.

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EASTMAN PREMO CAMERA, No. 1, 3¼ x 4¼. Will exchange for a punching bag in good condition, chest pull, wall exerciser and hand grips, or a telescope of at least 25 power.—Jack Quelle, 1123 Franklin St., Burlington, Ia.

MOTION PICTURE CAMERA, specially made for advertising purposes. Complete with special bulb. Original value $100. Will trade for typewriter, used motorcycle engine or used Model T Ford.—J. D. Guthre, Louderton, Pa.

MOVIE PROJECTOR, Keystone, almost new with 400 feet of film. Cost $10. Will trade for a small gasoline engine or what have you?—Wayne Cargill, Pasadena, Tex.

MOVIE PROJECTOR WANTED in exchange for Martin C Melody Sax with case. In good condition.—H. B. Dickey, 219 Broadway, Macon, Mo.

MOVIE PROJECTOR for standard size film, motor driven, used very little. Also an 8 in. swing lathe with 6 ft. bed, one new $172, 23 jewel Hamilton watch, one Mosely watchmaker's lathe with 40 chucks and slide rest. Will trade for Aeronca Motor C-3. Also need propeller, 6 ft., landing gear or lightplane. What have you?—L. W. Hoyt, Deland, Fla.

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HIGH SCHOOL COURSE WANTED, have much to trade.—A. Peter Lassila, Box 17, Mohawk, Mich.

COURSES. Will trade any of the following for a reasonable offer. $180 I. C. S. Automobile Course, $130 I. C. S. Radio Course, $145 I. C. S. Advertising Course, $195 Electric Engineering Course, $175 I. C. S. Full Commercial Course.—V. E. Parker, Murray, Utah.

COMPLETE LAW COURSE, American Extension, University of California. Will trade for airwheels or other aeronautic or other aeronautic or sporting goods.—V. D. Firestone, Kingfisher, Okla.

AVIATION GROUND COURSE, cost $69. Will trade for a good motorcycle in good running condition or a lightplane engine in running condition.—Harry E. Nungesser, R. R. 3, Galion, Ohio.

AVIATION COURSE, Dayton, 60 vols., cost $70, like new. Also a $165 Strad violin. I want an aircraft engine, plane less engine or what have you?—Louis Frantz, 605 Eighth St., New Brighton, Pa.

CARTOON COURSE, charts and all. Will trade for a pair of binoculars or a good typewriter. Lessons worth $45.—Ed T. Petch, 3219 W. 61st St., Cleveland, Ohio.

AVIATION COURSE, American, also Dykes book on aviation engines. I want a good typewriter, any make.—W. R. Privette, Covington, La.

AVIATION COURSE, Lincoln, 40 lessons. Also Brownie 4 shot automatic pistol and a Benjamin single shot air rifle. Will trade for a Harlequin engine in A-1 shape.—Charles Stiles, 816 Platte, Alliance, Nebr.

I. C. S. AUTO COURSE or a set of engineering books. Will swap for a model gas or compressed air motor.—Clifford Tanner, 1136 Park Ave., Cranston, R. I.

AVIATION COURSE, to trade for a cylinder head to fit a 1927 Chevrolet engine. No cracked heads. Have lots to exchange, what have you?—Geo. Jones, 924 Camp St., Indianapolis, Ind.

ENGINES AND ACCESSORIES

GNOME ROTARY ENGINE, almost new, spare parts. What have you?—Geo. R. Stubblefield, 426 W. Main St., Waterloo, N. Y.

ENGINE WANTED, a Henderson engine or any modern 'chute in good condition. Will trade a modern flat-back mandolin, almost new, and a good violin.—Box 1108, University, Va.

HEATH-HENDERSON ENGINE, lightplane type. Will exchange for an Outboard engine suitable for class A, B, or C racing. Even swap.—Chas. Lackey, 1143 Cherry St., Pottstown, Pa.

GNOME ENGINE, 100 h.p., aviation correspondence course, one pair of aero-boat floats and many other items. Send for list. Will trade for a metal cutting lathe, guns, rifles or pistols.—J. H. Hachmann, Bellevue, Ia.

BICYCLE ENGINE WANTED. What do you want?—Bruce Kuehnle, 310 S. Commerce St., Natchez, Miss.

1923 CHEVVY ENGINE, partly converted, good condition. Will trade it for a good pair of 18 x 3 or 20 x 2 wheels, tires and tubes. Please give axle size. What have you besides the wheels?—Wm. Brack, Jr., Factoryville, Pa.

HARLEY-DAVIDSON ENGINE, "Big Twin" with mag, in good shape, suitable for lightplane or hedgehopper. Will swap for a 1-cyl. engine, 2½ or 3 in., complete with ignition.—Herbe Pollard, Jr., 1116 Humbolt St., Fort Worth, Tex.

HENDERSON-4 ENGINE, less two pistons and con. rods. Will swap for Lawrance 2S crankshaft with hub assembly. Will pay cash difference if necessary.—Alfred Warriner, Jr., Thibodaux, La.

MODEL A, HISSO ENGINE, 150 h.p., 50 hours since government overhaul, with prop hub, booster mag. Consolidated "A" instrument panel listed at $60, some plumbing and fittings for the above engine. Everything is in good condition having been used four months in a new ship. Will trade all for a trombone, used light car or what have you?—Carl Anderka, Cozy Theater, Orange Grove, Tex.

LIGHTPLANE ENGINE WANTED, also Sky-Scout parts. Have S. A. E. 60 engine oil and the following guns: 1 12 ga. pump, 1 12 ga. single, 1 0.38 rifle, 1 0.45-0.70 rifle, 1 0.44 Colt revolver, 1 0.32 nickel plated automatic and 1 0.38 revolver.—J. D. Kelley, 1112 S. Haskell Ave., Dallas, Tex.

J-5 WHIRLWIND ENGINE, Hamilton Steel prop, spinner collector ring, engine cowling, etc. At present it is receiving a major overhaul. I will trade it for a Travel Air, Fleet, Bird or other similar plane. Will pay some to boot or take boot as warranted.—H. H. H. Clark, Kalispell, Mont.

BRIGGS & STRATTON ENGINE, ¼ h.p., one Harley-Davidson, 1927, 61 motorcycle engine less generator, 4-wheels with 28 x 3 tires in good shape, and Elgin watch. Will trade for a 3-cyl. Anzani engine, a 3-cyl. Wright-Morehouse or a 45 h.p. Szekely engine or any other engine from 30 to 65 h.p. radial type.—J. C. March, 1712 W. 16th St., Okla City, Okla.

BICYCLE ENGINE WANTED in good running order or the rear wheel. Will exchange $7.50 movie machine and $7 worth of standard size film.—C. S. Crutcher, Jr., R-3, Guthrie, Ky.

MODEL A FORD ENGINE WANTED, converted or plain. Also 20 x 4 tires and tubes. I have lots of Heath Parasol parts and other lightplane parts that I will exchange. Send your list and I'll send mine.—John Kamm, Oshkosh, Wis.

HENDERSON ENGINE, complete in all respects for aircraft use. Will trade this engine for an outboard engine to be used in a speed boat.—Jack Nogrody, 437 E. Myrtle Ave., Youngstown, Ohio.

SCINTILLA MAGNETO, 4-cyl., set of Pietenpol Air Camper wing ribs. Velie prop, hub for Model A Ford. Will trade for a motorcycle generator and battery, prop or high compression head for Model A Ford. What have you?—H. W. Brown, 501 4th St., So. Moorhead, Minn.

ENGINE BLOCKS (2) from discarded 4-cyl. motorcycle engines. Also crankshafts, timing gears and con. rods. What do you want?—J. R. Gay, Gretna, Va.

SECONDARY GLIDER, partly built, good workmanship. Designed by Martin Schempp. Will trade for motorcycle or what have you?—Elmer D. Zimmerman, Intercourse Glider Club, Intercourse, Pa.

EVANS GLIDER PLANS, many books and magazines, 12 ga. Remington repeating shotgun, in good condition. Will trade for typewriter or a Hinton home study course in aviation. What have you?—Oscar Sagli, R-1, Rathdrum, Idaho.

GUNS — SPORTING GOODS

0.22 WINCHESTER RIFLE, 18 shot, to trade for motorcycle in running condition. Also have a Harley powered lightplane (never flown) to trade for a motorcycle.—F. W. Ryan, Jr., Dalton, N. Y.

41 SWISS RIFLE, also 0.45 Colt double action, to trade for a good motorcycle and a good auto radio.—John Krahulik, 2242 S. Kedzie Ave., Chicago, Ill.

25-20 WINCHESTER RIFLE, lever action, good condition. The Model 1890 saddle gun. Will trade for a 30 h.p. Aeronca prop (E107A).—Leo E. Falk, Box 50, McIntire, Ia.

EXHIBITION TENT, 60 x 95, used just a few weeks, waterproofed, valued at $700. High class moulds for making plastex and marble art novelties. Build your own business. Will trade for a licensed Travel Air, Waco, American Eagle, OX-5 engine, Continental 40A engine or what have you?—L. C. Robie, Union Springs, N. Y.

GOLF CLUBS and bag, Officers' riding boots and breeches, set seven. Want motorcycle parts, lightplane parts, or what have you?—T. W. Hotze, P. O. Box 985, Richmond, Va.

REPEATING SHOTGUN, Western Field, 12 ga., 30 in. Barrel. Cost $30. Will trade for 10-12 binoculars, portable typewriter, piano accordion, back issues of P. A., Electric radio, short-wave converter, will also consider other offers.—Kendall Larkin, Box 103, Shannock, R. I.

0.25 SPANISH AUTOMATIC, 6 shot. Also a 0.22 single-shot Stevens rifle for a good jeweler's lathe with chucks. Have other things to trade for Luxor No. 7 goggles, or a Benjamin gun. What have you?—L. R. Fitch, Ja., 3109 N. 41st St., Lincoln, Nebr.

MACHINERY

JIG-SAW, hand or power, alcohol single burner stove, 2 U. S. Army mess kits, fielder's glove, pair of Iver Johnson tube skates, size 9.—Wm. Curtis, 23 Platt St., Albion, N. Y.

PRINTING PRESS, Baltimore No. 9, 6 ft. Skiis, model of Gee-Bee, 0.22 Winchester repeating rifle, folding Kodak, a 0.32 H & R revolver, to swap for a 0.30-30 rifle, Savage preferred. Will pay difference if any.—Geo. H. Warden, Locust Dale, Pa.

KOHLER GENERATING PLANT, 110 volt, a square grand piano and an electric milking machine. Will swap for a set of Delco batteries or what have you?—R. S. Werth, 2377 Rhode Island Ave., Washington, D. C.

SMALL TABLE SAW, Lathe, Planer and bandsaw. What do you want?—Sterling Hostetler, Topeka, Ind.

MODEL AIRPLANES

MODEL PLANS for Great Lakes trainer, Curtiss Hawk P6E, Sopwith Camel, Spad, Nieuport, Fokker triplane, SE-5, Curtiss A-8, Hell Diver. These must be Cleveland plans. Will trade for all sorts of plans and model material.—Ian Symington, 516 7th St., Huntington, W. Va.

MODELS BUILT TO ORDER running from one to five foot span, flying or scale models. What have you to trade?—Walley Babicky, 2326 N. 36th St., Milwaukee, Wis.

MODEL PLANS, new clean plans for 24 and 28 in. models. Will trade for good clean photos of planes. I also have 1½ in. celluloid wheels with landing gear that I will trade for anything usable. Send your lists and wants.—Foy Solly, 3046 N. Keating St., Chicago, Ill.

BLUEPRINTS, 36 factory drawn blueprints of all sizes up to 36 x 48 in. Many types of planes. Also a set of golf clubs with bag and two tennis raquets, never used. Will swap for model airplane or model supplies. What have you?—Geo. Goodhead, Jr., 1623 S. Quincy St., Tulsa, Okla.

MODEL PLANS WANTED. Exact scale model drawings of Stinson "R". Paging Mr. Bristol, Chetenne, Wyo. Will swap hand copied plans of U. S. Army ship, XP-934. What have you in the line of plans? Also want old Aerial Age magazines of 1920, 21-22. Single copies or vols.—Robert D. Hawkins, Ashley, Ind.

XUM

MODEL GAS ENGINE WANTED, about 1⅛ in. bore or less, in running condition or slightly damaged. What do you want in exchange?—Chas. Werve, Jr., 6502 Third Ave., Kenosha, Wis.

MODEL GAS ENGINE, ¾ x ¾ stroke and bore. Needs spark coil and carbureter adjustment. Also a 3-cyl. compair engine, like new. Will swap for Maytag engine in running condition or slightly out of repair.—L. E. Meloon, 31 Maye Ave., Buffalo, N. Y.

MODEL PLANS, books and mags wanted. Send in your list and I'll send mine. Old Number of P. A. wanted.—W. Fortune, Jr., 100 McDougal St., Brooklyn, N. Y.

MODEL SUPPLIES WANTED. Will trade almost anything for model airplane supplies, plans, material and books on model building. Will also trade for Model Airplane News and P. A.—Norman Zipkin, 704 F St., N. E., Washington, D. C.

FISHER BODY KIT with all aluminum castings finished and with all wood, metal parts and materials for sewing semi-finished. Would like to trade for a 3-cyl. or 4-cyl. compressed air motor with tank.—Robert Shelton, 1353 Ingraham St., N. W., Washington, D. C.

SCALE MODEL. I have an official Curtiss-Wright scale model of the Travel Air Mystery Ship which cost me $5.50. It has an aluminum cowl and a Standard Steel die cast prop. Will trade this model for any Cleveland kit that hasn't been touched. Would prefer the Supermarine S-6-B kit.—Joe Albanese, 250 W. 23rd St., Chicago, Ill.

BALSA STRIPPER, new, and P-12 plans. Will trade for accurate scale drawings of A-8, Vega, F9C-2, P-26, Helldiver or other modern ships.—Earl Stahl, 810 Sutter St., Johnstown, Pa.

MODEL SPEED BOAT PLANS WANTED, also plans for model sailing craft and South Seas craft. Plans may be simple or completely detailed. Please send lists.—John Alfirevic, 2718 S. Lawndale Ave., Chicago, Ill.

MOTORCYCLES

2-CYL. MOTORCYCLE WANTED in running condition. Have many things to exchange. Will add cash if necessary.—David Smith, 139-11 223 St., Laurelton, N. Y.

1930 HARLEY-DAVIDSON, 45 motorcycle in excellent condition. Will trade above and add some cash for a lightplane or a Model A roadster. Also a Bosch DU-4 mag, just overhauled and in perfect condition. A Harley-Davidson "74" engine and other things to trade for a Model T overhead. Would like to get a Fronty or big Raja head.—Larry Liebers, 1300 S. 40th St., Lincoln, Nebr.

1931 INDIAN MOTORCYCLE with many extras. Has only 7,000 miles and is in perfect condition. Will trade for a 2-place or 3-place airplane, licensed or eligible for a license. A slight crack-up considered.—Len. Blum, 551 E. 19th St., Paterson, N. J.

1924 INDIAN SCOUT, a correspondence course, camera and radio. Wish to trade for a late model motorcycle—an Indian preferred.—Will give balance in cash.—Dorl G. Lathrop, Burlington, Kan.

HARLEY-DAVIDSON TWIN WANTED, a good machine in good condition. I have many things to trade—what have you?—Spud Bone, Herndon, Kan.

1926 INDIAN TWIN with a new clutch, good tires and spare cylinders. It has no battery nor generator. I also have an Indian Twin opposed motor without mag or carbureter.—George Gadrew, 416 Viola St., Camden, N. J.

MOTORCYCLE WANTED, either a Henderson 4-cyl. or an Indian 4-cyl. Don't care if it needs overhauling if none of the parts are broken. I will trade a Maytag engine, a movie projector, model airplanes or balsa wood.—Frank Fernandez, 2912 Main St., West Tampa, Fla.

MISCELLANEOUS

LACQUER SPRAY GUN. A Binks gun including condenser; a practically new saxophone, value $135; a Puritan vending machine and some stock in a good corporation to trade for a lightplane, preferably a Heath or an Arrow sport plane. What have you?—Milton Lipscomb, Wymore, Nebr.

80-BASS ACCORDION and a drum set to trade for a lightplane, engine or instruments.—Frank Ken, 2131 Ruffner St., Philadelphia, Pa.

COMPASS, aero books and many other items to trade for a pair of Lucor or protectors with curved lenses.—Cletus Jerger, 512 Clinton St., Martins Ferry, Ohio.

PANTOGRAPH WANTED, suitable for enlarging or diminishing scale drawings of aircraft. Drawing board and other drafting equipment also wanted.—William Neubauer, North Olmstead, Ohio.

WORK will be exchanged for lightplane, flying or mechanics course.—Ezra Payton, Novinger, Mo.

PHOTOGRAPHS—RELICS

RELICS. Will trade World War and other relics for obsolete aircraft engines. I also want engineer's surveying instrument or telescope.—S. K. Creel, Parkersburg, W. Va.

GERMAN HELMET and airplane photos to trade for Kodak with anastigmat lens or photos of modern military planes.—Roger Saunders, 5512 Maple Ave., St. Louis, Mo.

PHOTOS, gloss finish, actual photos of famous flyers on visits to Detroit. Also noted planes and views of all airports in this vicinity to trade for good aerophotos or U. S. Commemorative and Air stamps. Send your list.—Don Smith, 15449 Dexter Blvd., Detroit, Mich.

NORGE DIRIGIBLE. I have six original pictures of the ill fated Norge dirigible, framed with a piece of fabric taken from the wreck of the Norge.—Joe Bonome, 661 Englewood, Ave., Chicago, Ill.

GERMAN GAS MASK with case, German helmet. What have you to trade for these articles?—Chas. Kinch, Los Altos, Calif.

CURIOS WANTED, all sorts of war curios, cartridges, weapons, books and model magazines.—John Alfirevic, 2718 S. Lawndale Ave., Chicago, Ill.

RADIO SETS—SUPPLIES

RADIO PARTS WANTED, taken from old battery sets or anything that can be used to make a short-wave receiver. Will trade model airplane material and other things of value.—C. E. Salsbury, 24 Lennon St., Providence, R. I.

AUTO RADIO RECEIVER complete with dynamic speaker, in perfect condition, worth $30. Also new and partly used printing supplies. Want Indian, Ace, Henderson motorcycle, motor or motor parts. Also, 20x4 S.S. airplane tires and machine shop equipment.—R. M. Coates, 6 Marion Road, Upper Montclair, N. J.

VICTOR BATTERY RADIO, 5 tube, complete with batteries and loud-speaker—no aerial. Good condition. Prefer to trade in Canada on account of duty. What have you?—Bob Jackson, P. O. Box 190, New Glasgow, Nova Scotia, Canada.

AIRCRAFT BEACON RECEIVER, R. C. A. Model AR, with remote control unit and tubes. In good working order. Will trade for Velie M-5 engine or engine of equal horsepower. Will not consider cracked engines or rebuilt car engines.—Floyd E. Wyman, 1411 N. 38th, Kansas City, Kan.

NEW AND USED RADIOS. Have many radio receivers. Also radio parts for exchange on airplane instruments, accessories, books on aviation or meteorology.—J. L. Zimmerman, Jr., 225 Wyoming St., San Antonio, Tex.

RADIO RECEIVERS, parts of a 3-tube long-wave and a 1-tube short-wave receiver. Also one 4'-6" prop, slightly chewed at ends. Would like to trade for 1-tube short-wave in working condition or an electric motor.—William Beel, 220 Eyre St., Sudbury, Ont., Canada.

RADIO PARTS, bicycle, electric trains and books. Will exchange for light motorcycle or motor, outboard motor, accordion, glider wings or small wheels.—Adrian Bos, Jr., 180 Suffolk Road, Island Park, N. Y.

STAMPS—AIRMAIL COVERS

SCOTT ALBUM, nearly filled with stamps from many countries. Will trade for rebuilt flying scale models or what have you?—Walter Bard, 833 S. Victory St., Waukegan, Ill.

STAMP KITS. Foreign and American stamps between 20 and 80 years old. Also books, pedigreed homing pigeons. Willing to exchange for good aviation books or anything that I can use.—Lionel Willet, 47 Garfield St., Lawrence, Mass.

Stress

(*Continued from page* 116)

times the vertical side the stress in the strut is 3.17 times 250, or 792 pounds.

This is the simplest and quickest way of getting the stresses in such a truss and you should have no trouble in getting it entirely clear. You can use this method for many purposes, so don't fail to make sure you understand it perfectly.

A little thought will show that since the lift load is upwards, hence the strut must be in tension. Such being the case, the beam must be in compression, as it is being pushed inwards by the pull of the strut. We find that, for a load of 300 pounds being lifted by our wing, we have a tension stress of 792 pounds in the strut and a compression stress of 750 pounds in the beam.

Different strut locations change these values greatly and if you will run off a few experimental calculations such as the above you will find that very large stresses may be developed if the strut location is not carefully figured. The nearer this location is toward the fuselage the greater the stresses, other things being equal. Now is a good time to analyze your own ship, figuring each pair of beams and struts, the same as we have here with the single members.

While this is a very primitive variety of mathematics and will cause some of you to smile, it is the only kind that is within reach of many beginners, so it has its place. In our fight for the right to do experimental building and flying we can't afford to overlook any bets and any knowledge that will make our game safer and better understood is valuable. Stress analysis should NEVER take the place of actual static tests, but it has its place. In a later article I shall try to show how the various stresses are divided between the usual two beams and two struts used in the standard type of wing.

CLASSIFIED

LINCOLN PT AIRPLANE, KINNER POWERED, good condition, licensed, standard equipment and color, $475. IRVIN EXHIBITION PARACHUTE OUTFIT includes 28 ft. seat pack and 24 ft. breast pack and equipment $195. Complete set 104 CADET SYSTEM WALL CHARTS and fixtures $35. AIRWAYS EQUIPMENT COMPANY, Box 890, Birmingham, Ala.

PATENT Your Invention—"Little Ideas May Have Big Commercial Possibilities." Send for free book. "How to Obtain a Patent and Record of Invention Blank." Prompt service. Highest references. Reasonable charges. Deferred payments. Established 1898. Victor J. Evans & Co., 790 Victor Building, Washington, D. C.

MOTION PICTURE Bargains. News reels $2.25, odd reels $1.50. Bargain lists. Hoffman Film Service, 57 Broad, Albany, N. Y.

BIG MONEY Applying Gold Initials on Automobiles. Easiest thing today. No experience needed. Free Samples. "RALCO," 1084 Washington, Boston, Mass.

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20" WING SPAN
GUARANTEED TO FLY
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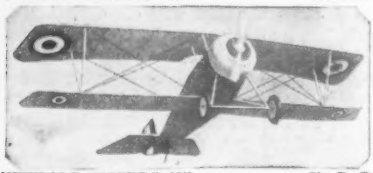

NIEUPORT "SCOUT," 20" 50c P. P.

WACO MODEL "A," 20" 50c P. P.

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BELLANCA "PACEMAKER," 20" 50c P. P.

VANCE "FLYING WING," 20" 50c P. P.

CURTISS "GOSHAWK," 20" 50c P. P.

FAIRCHILD "22," 20" 50c P. P.

SCIENTIFIC MODEL AIRPLANE CO.
277P HALSEY ST., NEWARK, N. J.

Airport Conduct

(*Continued from page* 98)

mechanics or the manager if they ask you or are not busy.

5. Don't try to impress the spectators. On the ground you are a nuisance and in the air you are a menace. Fly quietly and conservatively. You might not impress all of the spectators but you will those who know the game.

6. Be modest. Don't try to excuse a poor landing. Admit that you couldn't fly a kite and do better next time. If you have a grand total of twenty hours don't boost it to a hundred. Above all, don't boast of your flying ability to strangers. They usually turn out to be Doolittle or the senior mail pilot of the division. Anyhow, it's bad luck to apply too much publicity, and even though you may not believe in a personal jinx, it seems as though one always follows after a little bragging.

V. VISITING PILOTS

1. If you are around the hangar when a stranger drops in, tell the manager that you would be glad to give the visitor a lift to town or put him up for the night at your home.

2. If he accepts your hospitality don't force yourself on him. He is usually very tired and doesn't want to go to a show or party.

3. Quite often he wants to leave at daybreak. Phone the field and get the winds aloft and the weather. Write it on a slip of paper and give it to him at breakfast.

4. Remember that any little kindness that you might do him will be repaid with interest when you land at his home field.

VI. DEPARTMENT OF COMMERCE INSPECTORS AND MANAGERS

1. Don't forget that they are on the job to make flying safe. It is a hard job and don't make it any harder for them. They know their job so don't argue with them.

12" Ornamental Models

Photograph of the Hawk P-6-E Model

AT LAST. A striking, true scale reproduction of the famous CURTISS HAWK P-6-E and GEE BEE SUPER SPORTSTER at a price that you can afford. Each an art piece of rare beauty and distinction.

AMAZINGLY large and most complete CONSTRUCTION KITS to build these beautiful models for pleasure or profit are now available at the following SPECIAL PRICES: Curtiss Hawk P-6-E 12" Kit, only $1.70 each. Gee Bee S. S. 12" Kit, only $1.80 each. Postage 20c per kit extra. Please remit by Money Order or Check. Stamps not accepted.

Satisfaction Guaranteed or Money Refunded

RUSH 5c for new illustrated descriptive folder and prices of 12" and 20" Finished Models, Kits, and Drawings. Actual photographs only 10c each.

VICTOR STANZEL
High Grade Model Aircraft
SCHULENBURG TEXAS

2. If the inspector orders you to recover a wing or install a new propeller or else . . . do it. He knows that repairs are expensive as well as you. He doesn't want to make it hard on you nor does he want to write 'propeller shattered in flight' on the accident report.

3. Cooperate with your airport manager. There are local traffic rules that must be obeyed in the interest of safety and it is his job to enforce them. Don't add to his troubles and for Pete's sake keep clear of the field when not landing or taking off.

VII. IN CLOSING

1 to 1000. A sensible take-off, a moderate climb, smooth turns and a well executed approach and landing is better flying than a chandelle take-off followed by a stall and a spin.

1001. Be yourself. Be sensible. Be willing to learn and ask questions. Let your friends say, "He is a good pilot," instead of "He *was* a hot pilot."

END.

Levitation

(*Continued from page* 96)

and then a long uniform return velocity answers the requirements.

In Fig. 10 we have an elaboration of the system indicated by Fig. 8. Here, an explosion of gasoline vapor in the combustion chamber drives the ball weights down quickly, giving the upward reaction. The balls then roll around the bend at the bottom and create an upward compression pressure against the valve which not only brings the balls nearly to rest but which also creates a secondary lifting force due to the upward compression pressure. The balls pass through the valve and then return to the combustion chamber for a second trip. This system therefore gives two lifting impulses per explosion and any number of units could be employed to give a smooth uniform lift.

Now, I do not pretend to have solved the problem of levitation by any means nor do I claim that all of the systems are entirely practical as they are shown. I have only endeavored to outline the principles of levitation so that other workers in the field could apply their ideas for bringing about a satisfactory solution. If this article should stimulate experiments along the line, the writer would feel amply repaid for his work.

END.

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Takes in 600 men this year for FREE FLYING TRAINING. Gives them over 200 SOLO HOURS. Special Uniforms, Transportation to the Field, LIVING EXPENSES, and $75 a month while Learning. Real Flying Here. It costs absolutely nothing. Let Us Tell You How to Get In. Information about Uniforms, Rank, Leave, and Actual Life at the New $10,000,000 Field. Hand postman $1 and postage for entire information. Complete. Nothing else to buy.

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401 Judson B. Rives Bldg. Los Angeles, Calif.

Model Waco

(*Continued from page* 122)

ple as the struts are cut from solid balsa ⅛ inch thick. These struts are braced by two small bamboo splints 1/8 x ⅛ inch streamlined. The large wide struts are attached after the body has been completely assembled and covered. The struts should be attached to a solid piece or section of the body, not only up against the tissue paper.

Constructing the Wheel Pants. One inch diameter wheels should be used on this model and each pant is made up of three balsa sections. The overall height and length of the pant measurements are used by ⅜ inch for the correct thickness which part will be the center of the pant. Cut out a semi-circular section which will receive the wheel. Cement your sides against this center piece and then cut and sand this unit to the shape of the pant as illustrated in the drawing.

The wheel is held in place by a heavy pin or short piece of piano wire. After the wheel has been assembled into the pant the entire unit is attached to the landing gear strut by cementing at the lower apex of the landing gear unit. In addition to cementing, these units may be strengthened by the use of a thin piece of piano wire which is cemented against both the strut and the wheel pant.

Carving the Propeller. The propeller used for the flying model should be 7 inches in diameter and the cross sections of this blank should be ⅞ inch thick by ⅝ inch wide. The method of carving is illustrated in the small sketch included in this article. The hub of the propeller should remain thick and strong and gradually taper towards the tip. The correct thickness need not necessarily be greater than would be required to keep the blades from bending too readily when touching with fingers.

Covering the Model. All the parts of the model should be completely covered before the final assembly. The entire body should be covered with red tissue and all the remaining parts with white tissue. Thin celluloid should be used for the windows. The outline of the ailerons, rudder and elevators should be made with black tissue approximately 3/32 inch wide. The motor cowl should be cemented against the nose in a permanent position. The top wings are cemented securely against the fuselage uprights and at this time the angle of incidence and the dihedral should be checked.

The angle of incidence should be ⅛ inch. The lower wings are cemented directly against the fuselage. Note that the stagger is very pronounced. After the wings are cemented to the body, and have dried, the "N" strut on each side should be attached. It is advisable to put the "N" strut in between the wings in sections. Cement the vertical upright between the wings on both sides first. Be sure that both of these pieces are of the same length. Next, cement the front section of the strut in place, again checking both left and right strut parts.

The rear part of the strut should now be attached, and care should be used so that the lower or upper wings are not distorted. The stabilizer and rudder are cemented to the rear of the fuselage and if desired a small additional amount of streamlining may be completed over the stabilizer and against the rudder to the rear of the body.

The last and final step is placing the propeller and rubber motor into the body.

END.

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Curtiss Super Hawk

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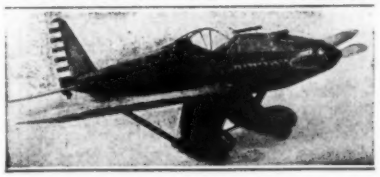
Construction Set, Complete.....$1.00 P.P.

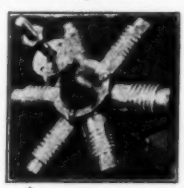
Curtiss XP934 Pursuit



18" Span. Weight 1¼ oz.
Color yellow and olive drab. Flying Scale Model Set.....$1.25
24" Span. Construction Set Complete $1.75

Gee-Bee Supersportster

12" Span. Weight 1 oz.
A Flying Scale Model with wing lettering, all materials. Postpaid .....$ .50



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SF-3: DH-4 Battle plane (undersize ¼")
SF-4: Curtiss Jenny (undersize ¼")
SF-8: Boeing P12B (old style)
SF-12: Nieuport Scout (old style)
SF-14: Richthofen's Triplane (old style)
FL-201: Cleveland Robin
FL-202: Cleveland Sirius
FL-203: Cleveland Bull-Pup
FL-302: Cleveland Trimotor
FL-303: Cleveland Pirate Bomber
FL-304: Cleveland Commodore F. Boat

Order from this List or for a complete list of C-D Supplies and Kits, refer to your copy of our List No. 11. If you haven't one, send a 3c stamp for a copy at once.

18" SHEET BALSA

1/32 x 2"	$ .02
1/16 x 2"	.03
1/8 x 2"	.04
3/16 x 2"	.05
1/4 x 2"	.06

18" STRIP BALSA

1/16 x 1/16"	4 for	$ .01
1/16 x 1/8"	3 for	.01
1/16 x 3/16"	2 for	.01
1/16 x 1/4"	2 for	.01
1/16 x 5/16"	2 for	.01
1/8 x 1/8"	2 for	.01
1/8 x 3/16"		.01
1/8 x 1/4"		.01
1/8 x 5/16"		.01
1/8 x 3/8"		.02
1/8 x 1/2"		.02
3/16 x 3/16"		.01
3/16 x 1/4"		.02
1/4 x 1/4"		.02
1/4 x 5/16"		.03
1/4 x 1/2"		.03
3/8 x 3/8"		.03
3/8 x 1/2"		.04
1/2 x 1/2"		.05

BULK BALSA

1/2 x 3 x 18"	$ .18
1 x 3 x 18"	.20
2 x 3 x 18"	.25
1 x 6 x 36"	.40
2 x 6 x 36"	.75

ENAMEL DOPES

Often imitated, but never duplicated. Diana Cream, Military Yellow, International Orange, Grass Green, Fire Chief Red, Army Olive Drab, Navy Blue, Havana Brown, Glistening White, Glossy Black, Silver, Gold, Clear. 1 oz., 12c; 2 oz., 20c

PAPER CEMENT

1 oz., 12c; 2 oz., 20c

COLORLESS W'PROOF CEMENT

1 oz., 12c; 2 oz., 20c

TISSUE

No. 1 (cream), heavy size 25x36	$ .10
No. 2 (very light cream), size 21x31	.04
No. 3 (white), size 20½x24½	.03

CELLULOID

Clear, size 2x6.....$ .03

MUSIC WIRE

No. 5 1 foot	$ .01
No. 8 1 foot	.01
No. 13 1 foot	.01
No. 14 1 foot	.01
No. 26 1 foot	.01
No. 26 1 foot, Hinge wire, 2 for	.01

RUBBER

3/64 Sq. (.045")

7½ ft.	$ .04
25 ft.	.12
210 ft.	.70

1/32 x 1/8

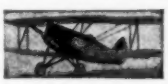
7½ ft.	$ .05
25 ft.	.16
210 ft.	1.10

1/32 x 3/16

7½ ft.	$ .07
25 ft.	.25
210 ft.	1.70

N. B. Be sure to include 15c packing charge with your supplies order.

Four Exceptional "C-D" Kit Values



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Span 20"; length 15¼"; weight 1.2 oz. Colored international orange and black. Kit SF-1 $1.95.

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